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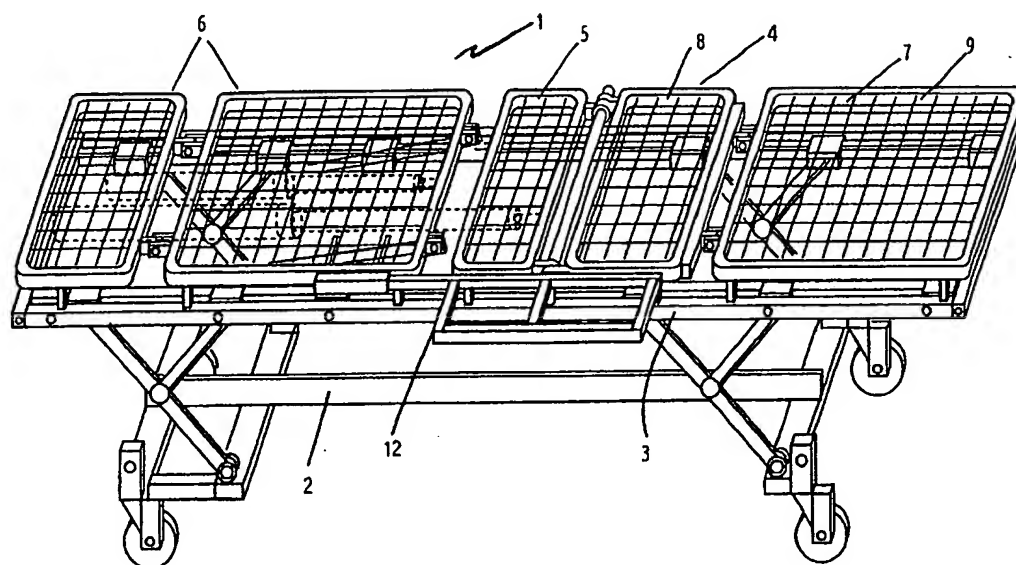
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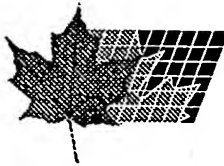
(54) **DISPOSITIF PERMETTANT DE METTRE DES INVALIDES
DANS DIFFERENTES POSITIONS**

(54) **APPARATUS FOR HANDLING INCAPACITATED PATIENTS**



(57) Ce lit (1) présente un cadre de base (2) ainsi qu'une plate-forme de support (3) d'un patient, placée sur le cadre (2) et mobile par rapport à celui-ci. Un entraînement déplace la plate-forme sur le cadre (2). La plate-forme (3) comprend un sous-cadre (4) présentant un certain nombre de panneaux mobiles par rapport à celui-ci. On utilise un mécanisme d'entraînement de panneau pour déplacer les panneaux sur le sous-cadre (4). Ces panneaux comprennent un panneau central présentant un panneau côté tête (6), monté à une extrémité du panneau central (5), ainsi qu'un panneau côté pieds (7) monté à l'autre extrémité du panneau

(57) A bed (1) has a base frame (2) and a patient support platform (3) on the base frame (2). The patient support platform (3) is movable on the base frame (2). A drive moves the platform on the base frame (2). The patient support platform (3) comprises a sub-frame (4) with a number of panels which are movable on the sub-frame. A panel drive mechanism is used to move the panels on the sub-frame (4). The panels comprise a central panel with a head panel (6) mounted at one end of the central panel (5) and a foot panel (7) mounted at the other end of central panel. The head panel (6) is pivotally movable relative to the central panel (5). The head panel (6)



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central. Le panneau côté tête (6) est monté pivotant par rapport au panneau central (5). Le panneau côté tête (6) et le panneau central (5) sont relativement mobiles entre une position sensiblement plane, dans laquelle ils sont en ligne, et une position décalée, dans laquelle ils sont situés dans des plans sensiblement parallèles, espacés l'un de l'autre.

and central panel (5) are relatively movable between an in-line substantially pro-planar position and an offset position in which the head panel and central panel lie in spaced-apart substantially parallel planes.

APPARATUS FOR HANDLING INCAPACITATED PATIENTS

This invention relates to a bed and other apparatus for handling of incapacitated patients.

- 5 The problems associated with the treatment and movement of patients into and out of beds are well known. Particularly for severely incapacitated patients, the movement of the patients can cause strain and injury to both the patient and to attendants handling the patient.

It is an object of the present invention to alleviate these problems.

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According to the invention, there is provided a bed comprising a base frame, a patient support platform on the base frame, the patient support platform being movable on the base frame, and platform drive means for movement of the platform on the base frame.

- 15 In a preferred embodiment of the invention, there is provided a bed comprising a base frame, a patient support platform on the base frame, the patient support platform comprising a sub-frame with a number of panels which are movable on the sub-frame. and panel drive means for movement of the panels on the sub-frame.

- 20 In a particularly preferred embodiment, the panels comprise a central panel with a head panel mounted at one end of the central panel and a foot panel mounted at the other end of the central panel.

In another embodiment, the head panel is movable relative to the central panel.

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Preferably, the head panel is pivotally movable relative to the central panel.

- Conveniently, the head panel and central panel are relatively movable between an in-line substantially pro-planar position and an offset position in which the head panel and central panel lie in spaced-apart substantially parallel planes.
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- 2 -

In a further embodiment, the central panel is pivotally mounted on the sub-frame.

In another embodiment, means is provided for interlocking the head panel and the central panel. Conveniently the head panel and the central panel can pivot together in the interlocked
5 position on the sub-frame.

In another embodiment, the foot panel is movable relative to the central panel.

In a preferred embodiment, the foot panel is pivotally movable relative to the central panel.
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In a particularly preferred embodiment, the foot panel is of two-part construction comprising an inner panel and an outer panel, the inner panel and outer panel being hingedly interconnected for relative movement of the inner and outer panels between an in-line flat position and an angled position.
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In another embodiment, a leg support member is mounted at a side of the patient support platform.

Preferably the leg support member is movable between a stored position underneath the
20 patient support platform and an engaged position extending outwardly of the patient support platform.

Conveniently, the leg support member is pivotally movable on the patient support platform.

25 In a preferred embodiment, the leg support member is mounted on the head panel.

In another embodiment, the patient support platform is vertically movable on the base frame.

In another embodiment, the patient support platform is pivotally movable relative to the base
30 frame. In this way, the patient support platform may be tilted about a transverse and/or longitudinal axis of the patient support platform.

- 3 -

In a preferred embodiment, the drive means is operable to oscillate the patient support platform on the base frame.

- 5 In a particularly preferred embodiment, the drive means comprises a drive motor connected to a drive shaft, one or more drive mechanism mounted on the drive shaft, the or each drive mechanism being operable to engage or disengage with the drive shaft, and drive linkages connected between the or each drive mechanism and a panel or patient support platform for movement of the panels and patient support platform.

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The invention also provides a buggy having a wheeled base and co-operating means for engaging complementary engaging means on the seat whereby the buggy may be used to move the patient seated in the seat to and from the bed.

- 15 The invention further provides a pedestal having co-operating means for engaging the complementary engaging means provided on the seat whereby the seat and patient may be transferred from the buggy to a fixed pedestal.

Advantageously, the invention includes a hoist having co-operating means for engaging the
20 complementary engaging means provided on the seat, the hoist including a wheeled base and lifting means to enable the seat and patient to be lifted into and out of a bath, shower or the like.

The invention will be more clearly understood by the following description of some
25 embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which :-

Fig. 1 is a diagrammatic perspective view of a bed according to the invention including a leg rest extending from the side thereof;

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- 4 -

Figs. 2 and 3 are schematic plan views of the leg rest in the extended and retracted modes respectively;

Fig. 4 is a partially exploded perspective view of the bed shown in Fig. 1 with the elements on the upper surface of the bed shown dotted for clarity;

Figs. 5 and 6 are detailed side views of portions of the bed;

Figs. 7 to 9 are diagrammatic perspective views of the bed, showing a patient support platform of the bed in different positions of use;

Figs. 10 to 14 are diagrammatic perspective views of the bed showing a sequence of steps in which the patient support platform is manipulated for positioning a patient in an upright sitting position on the patient support platform;

Figures 15 to 19 are diagrammatic perspective views of the bed similar to Figs. 10 to 14 showing a sequence of steps in which the patient support platform is manipulated for positioning a patient in an upright sitting position in a seat for use in a patient handling system according to the invention;

Figs. 20 to 24 are diagrammatic perspective views of the bed showing manipulation of the patient support platform in a number of steps for movement of a patient on the platform between an upright sitting position and a supine position on the patient support platform;

Figs. 25 to 28 are schematic perspective views of the bed showing an alternative mode of operation of the panels of the patient support platform;

Figs. 29 and 30 are end elevational views of the bed showing tilting of a patient support platform of the bed;

- 5 -

Fig. 31 is an end elevational view illustrating oscillation of the patient support platform of the bed;

5 Figs. 32 and 33 are side elevational views illustrating tilting of the patient support platform;

Fig. 34 is a detail perspective view of a hoist for use with the bed;

10 Fig. 35 is a detail perspective view of an upper portion of the hoist which is adapted for use with a lifting bracket;

Fig. 36 is a side elevational view showing a leg of the bed of Fig. 1;

15 Fig. 37 is a side elevational view showing the leg of Fig. 36 in an extended position;

Fig. 38 is a side view of portion of a modified bed;

20 Fig. 39 is a side view of the bed of Fig. 38 attached to an upright support leg;

Fig. 40 and Fig. 41 are side views of the bed of Fig. 38, showing tilting of the patient support platform about a transverse axis of the bed;

25 Fig. 42 is a schematic perspective view of the bed of Fig. 38, showing the patient support platform legs in a lowered position;

Fig. 43 is a schematic perspective view showing the legs in a raised position;

30 Figs. 44 and 45 are schematic perspective views showing respectively (a) the front legs in a raised position and the rear legs in a lowered position and (b) the rear legs raised and the front legs lowered;

- 6 -

Fig. 46 and Fig. 47 are schematic perspective views showing the legs arranged for tilting of the patient support platform about a longitudinal axis to one side and the other side respectively;

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Fig. 48 is an exploded schematic perspective view of the base of another bed;

Fig. 49 shows perspective views of a seat and a buggy for use with a patient handling system according to the invention;

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Figs. 50 to 52 are three side views of a connector used in connecting the seat and the buggy for use with the patient handling system;

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Fig. 53 is a perspective view of the seat and Fig. 54 is a perspective view of the seat in an upside down position;

Fig. 55 is an elevational view of a pedestal for use with the patient handling system;

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Fig. 56 is a plan view of a pallet for supporting the seat on the bed;

Fig. 57 is a perspective schematic view of a hoist for use with the patient handling system and Fig. 58 is an enlarged view of a cradle forming part of the hoist;

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Fig. 59 is an exploded side elevational view of another bed;

Fig. 60 is a side elevational view of the bed of Fig. 57 shown in one position of use;

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Fig. 61 is a view similar to Fig. 58 showing the bed in another position of use;

- 7 -

Fig. 62 is an elevational view of a leg mechanism for the bed of Fig. 57; and

Fig. 63 is an elevational view of the leg mechanism shown in a collapsed position.

Fig. 64 is a perspective view of a frame portion of a bed;

Fig. 65 is a diagrammatic perspective view of drive means forming portion of the bed shown in a Fig. 64 with the outer cover removed;

Fig. 66 is a plan view of a drive mechanism forming portion of the drive means;

Fig. 67 is a perspective view of the drive mechanism from one side;

Fig. 68 is a perspective view of the drive mechanism partially disassembled;

Fig. 69 is a perspective view of the drive mechanism disassembled further;

Figs 70 to 72 are three end views of the drive mechanism in three different sequences;

Figs. 73 to 75 are side views of the drive mechanism showing the extent of movement generated;

Fig. 76 is an exploded view showing the portion of the mechanism including the solenoid block;

Fig. 77 and 78 are side views respectively from both sides of the solenoid block;

- 8 -

Fig. 79 is a side view showing a breakdown of the individual components of the drive mechanism; and

Fig. 80 is a schematic table showing the sequence of the operating steps of the mechanism.

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Referring to the drawings, there is illustrated a bed according to the invention indicated generally by the reference numeral 1. The bed 1 has a ground engaging base frame 2. A patient support platform 3 is mounted on the base frame 2 and is vertically movable on the base frame 2 between a lowered position as shown in Fig. 10 and a raised position as shown in Fig. 1.

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The patient support platform 3 comprises a sub-frame 4 with a number of panels which are movable on the sub-frame 4. In this case, the panels comprise a central panel 5, a head panel 6 mounted at one end of the central panel 5 and a foot panel 7 mounted at the other end of the central panel 5. It will be noted that the foot panel 7 is of two part construction comprising an inner panel 8 and an outer panel 9 which are hingedly interconnected for relative movement of the inner panel 8 and the outer panel 9 between an in-line flat position as shown in Figs. 1 and 2 and an angled position as shown in Figs. 8 and 9.

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The head panel 6 is pivotally movable relative to the central panel 5. Thus, the head panel 6 can be pivoted upwardly from a horizontal position as shown in Fig. 1 to a raised inclined position as shown in Fig. 7.

The head panel 6 and central panel 5 are also relatively movable between an in-line co-planar position as shown in Fig. 11 and an offset position as shown in Fig. 12 forming a step 10 between the head panel 6 and central panel 5. Means is provided for interlocking the head panel 6 and central panel 5 in the stepped position shown in Fig. 12 so that the head panel 6 and central panel 5 may be pivoted together on the sub-frame 4 between a generally horizontal position as shown in Fig. 12 and a substantially vertical position as shown in Fig. 14.

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- 9 -

A leg support bracket 12 is pivotally mounted on the head panel 6 for movement between a stored position (Fig. 10) below the patient support platform 3 and engaged position (Fig. 11) extending outwardly of the patient support platform 3. The leg support bracket 12 is
5 mounted via two hinged rods 13 that slide in two outer tubes 14 which are welded to the head panel 6. This arrangement allows the leg support plate to hinge down and back out of the pick up line between the buggy and the seat as shown in Fig. 10.

In use, with the panels 5, 6, 8 and 9 in a horizontal position as shown in Fig. 1, the bed 1
10 functions as a conventional bed. The patient support platform 3 can be raised and lowered on the base frame 2 for positioning the patient support platform 3 at any desirable height which may be convenient for getting a patient into and out of the bed 1. also for handling of a patient on the bed 1 by attendants.

15 For comfort, the head panel 6 may be elevated as shown in Fig. 7 to support a patient in an inclined position for reading or eating for example. Further, the foot panel 7 may be bent into a cranked position as shown in Fig. 8 to support the patient's legs in a bent position. Further, the foot panel 7 may be raised by pivoting the foot panel 7 on the central panel 5 as shown in Fig. 9 for elevation of a patient's feet. The pillow section of panel 6 is also movable for
20 comfort.

Referring now in particular to Figs. 10 to 14, there is shown a sequence of steps for manipulating the panels 5, 6, 8 and 9 to assist in raising a patient from a supine position to an upright seated position for removal of the patient from the bed 1.

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Starting from a position as shown in Fig. 10 where the panels 5, 6, 8 and 9 are in alignment in a horizontal position, the leg support plate 12 is pivoted upwardly and outwardly of a side of the patient support platform 3 into a generally horizontal position as shown in Fig. 11. The "torso lift" back rest movements of the head panel 6 by the electric actuators 19 are controlled
30 electronically. Extending and retracting the actuator to pre-set position one raises and lowers head panel 6 in the torso mode. Extending and retracting the actuators to pre-set position two

- 10 -

raises and lowers the back rest. The panel 6 in the torso mode is secured by the movement of the lifting mechanism into retaining brackets as in Fig. 5. The panel 6 in a back rest mode is secured in a similar manner as in Fig. 6. Next the patient support platform 3 is tilted sideways to assist in turning a patient on to their side and then the base of the support platform 3 is levelled again. The patient is arranged on the patient support platform 3 with the upper body of the patient on the head platform 6, and the upper legs of the patient bent so that they extend outwardly over the leg support bracket 12 which is raised simultaneously with panel 6 with the lower legs of the patient being folded into a bent position relative to the upper legs, the lower legs lying on and supported by the leg support bracket 12. Next the head panel 6 is raised vertically into the stepped configuration with the central panel 5 as shown in Fig. 12. The head panel 6 is locked in the stepped position relative to the central panel 5. Then the foot panel 7 is raised into the position shown in Fig. 13 with the inner panel 8 pivoting upwardly into a generally vertical position with the outer panel 9 pivoting relative to the inner panel 8 to lie into an inclined position as shown in Fig. 13. Then, as shown in Figs .17 and 18, a lifting seat 250 is placed in position behind the patient with a seat portion resting between the patient and the inner panel 8 and a back of the seat extending upwardly along the patient's back. In this position, the inner panel 8 will lie against and support the upper leg portions of the patient. Next, the interlocked head panel 6 and central panel 5 are pivoted upwardly together on the sub-frame 4 as shown in Fig. 12 into an upright position.

Simultaneously, the foot panel 7 is lowered and the panels 8, 9 are returned to the flat horizontal position. In this way, the patient is raised on the bed 1 into an upright seated position in the seat. The patient and seat can then be transferred to a buggy by either lowering the bed or using the lifting facility of the buggy for transfer to a pedestal, shower, toilet or elsewhere. (The buggy is described later). It will be noted that the step 10 formed between the head panel 6 and central panel 5 facilitates insertion of the seat and engagement of the seat by the buggy or other lifting means. It also positions the patient in the centre of the seat.

- 11 -

Returning a patient to a supine position on the bed is the reverse of the above-mentioned procedure, the sequence of the reverse steps being shown in Figs. 20 to 24.

Referring now to Figs. 29 to 33, tilting movement of the patient support platform 3 on the base frame 2 is shown. Figs. 29 and 30 show tilting of the patient support platform 3 about a longitudinal axis of the bed 1. Fig. 31 shows diagrammatically oscillation of the patient support platform 3 about the longitudinal axis of the bed 1. Figs. 32 and 33 show tilting of the patient support platform 3 about a transverse axis of the bed 1. It will be appreciated that the patient support platform 3 may be tilted as shown to improve the comfort of the patient or to provide access to or assist in movement of the patient on the patient support platform 3.

Drive means is provided for movement of the panels 5, 6, 8 and 9 on the sub-frame 4 and for movement of the patient support platform 3 on the base frame 2. The design of the bed allows its many movements to be activated by a total of four actuators 19, two controlling the base frame and two controlling all upper movements. This is made possible by the dedicated electronics incorporated in the mini computer control of the system.

Referring now to Figs. 7 to 9, the foot panel 7 is placed in the bent position shown in Figs. 8 and 9 by means of a linkage which is pivotally mounted on the sub-frame 4 and movable by means of a drive linkage which connects the linkage to an associated actuator of the drive means.

Figs. 5 and 6 show the head panel 6 which comprises a generally rectangular frame having scissors lift arms 85, 86 with fixed pivot points 87, 88. Arm 86 has a sliding pivot 89 on sub frame 4 and arm 85 has an end 90 which slides into retaining bracket 92. It engages bracket 91 only on the scissors lift as shown in Fig. 5.

To move the head panel 6 in the inclined position or comfort mode, lever arm 95 pivots about pivot point 96 from its home horizontal position to that shown in Fig. 6 when end B is engaged in bracket 92 as it raises into the maximum 70° position. End 88 of arm 86 becomes the pivot point for the panel 6.

- 12 -

During the scissors lift as in Fig. 5, the lever arm 95, end A is uppermost with end B below the sub frame 4. The same mechanism is of course at the other side.

- 5 Referring to Fig. 5, when the foot panel comes to vertical it locks onto the central panel 5 of sub frame 4 in order to provide a positive synchronised movement.

A drive linkage 28b connected to a drive mechanism 25 of the drive means is engagable with an associated lug on the foot panel 8 for synchronised rotation of the foot panel 8.

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Fig. 1 shows the foot panel 7 comprising the inner and outer panels 8,9 joined by hinges 110. The panels 8,9 are generally rectangular in shape.

- 15 It will be noted that in Figs. 1 to 6, the panels 5, 6, 8 and 9 are shown without associated mattresses for clarity. The mattresses are in two sections, one on panel 6 and one on panels 5, 8 and 9.

- Referring now to Figs. 34 and 35, there is shown a hoist 120 which optionally may be mounted on the sub-frame 4 for movement of a patient into an out of the bed. The hoist 120 comprises a tubular housing 121 which is pivotally mounted by support brackets 122 at a head end 123 of the sub-frame 4. The brackets 122 are attached to cross members 124 of the sub-frame 4. A lifting rod 125 is slidably mounted within the housing 121 and carries a boom 126 at its upper end. A rotatable pivot arm 128 connects to a lower end of the shaft 125 and is pivotally mounted by a pin 129 on the sub-frame 4. An actuating lug 130 on the arm 128 connects to a drive linkage 28 which is attached to an associated drive mechanism 25 of the drive means for pivoting the arm 128 to produce vertical movement of the shaft 125 for raising and lowering the boom 126 for lifting patients into and out of the bed. A number of rings 132 are provided on an underside of the boom 126 and a safety blanket (not shown) can be suspended from the rings 132 for lifting a patient into or out of the bed.

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- 13 -

Referring again now to Figs 1 to 6, the sub-frame 4 is mounted on the base frame 2 by means of four legs 172. Pairs of legs at each side of the sub-frame 4 are interlinked for synchronous operation. Each leg mechanism is shown in more detail in Figs. 36 and 37. The leg 172 comprises a mounting bracket 173 on an underside of the sub-frame 4 having an inclined elongate slot 175. A strut 176 has a lower end 177 pivotally mounted on the base frame 2 and an upper end 178 slidably engages the slot 175 by means of a sliding pin 179 at the upper end 178 of the strut 176. A cranked drive arm 180 is pivotally mounted intermediate its ends by a pivot pin 181 on the bracket 173. Outer ends 182, 183 of the drive arm 180 are pivotally connected intermediate the ends of the strut 176 and to a drive linkage 28 of the drive means. Operation of the drive means with the associated drive mechanism moves the strut 176 between a collapsed position as shown in Fig. 36 and an extended position as shown in Fig. 37 for lowering or raising the sub-frame 4 on the base frame 2. It will be noted that the configuration of the drive arm 180 and the inclined slot 175 ensures substantially vertical movement.

Fig. 42 is an end view of the bed showing the legs 172 supporting the sub-frame 4 in a lowered position. Fig. 44 is a similar view showing the legs 172 in a raised position. It will be noted that the legs 172 at one side of the bed are mounted by hinges 184 to the sub-frame 4 and base frame 2 to allow tilting of the patient support platform as shown in Figs. 44 and 45 about a transverse axis and in Figs. 46 and 47 about a longitudinal axis of the bed by extending and retracting the pairs of legs 172 the ends and sides of the bed 170 respectively.

Referring to Figs. 38 to 41, means for tilting the patient support platform about a transverse axis of the bed is shown. Pairs of legs 190 are pivotally mounted at each end of the sub-frame 4 and are movable by the drive means between a raised stored position and a lowered ground engaging position for raising an end of the bed as shown in Figs. 38 to 40. Thus, tilting of the bed about a transverse axis can be carried out as shown in Figs. 40 and 41.

Referring now to Figs. 25 to 28, another bed 200 is shown. Parts similar to those described previously are assigned the same reference numerals. In this case, in a sequence which is similar to that described previously with reference to Figs. 10 to 14, the panels 5, 6, 8 and 9

- 14 -

are manipulated for raising a patient from a supine position to an upright seated position without using a seat. In this case, however, the head panel 6 and central panel 5 are maintained in-line as shown in Figs. 27 and 28. This position allows the patient a further option.

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Referring now to Fig. 48, there is shown the base of another bed the upper position of which is largely similar to the beds described previously. In this case, a cross-shaped sub-frame 224 is mounted on a pedestal-type base frame 222.

10 Referring now to Figs. 49 and 54, there is shown a seat 250 for use in moving a patient around and it may be used in combination with the beds previously described. A commode style seat (not shown) may also be used for toileting, bathing, and the treatment of a patient. Although not shown, all seats may have safety straps and supports fitted where necessary. Pick-up points 254 are provided on the seats 250, 252 to facilitate lifting of the seats 250, 252
15 by means of a buggy or hoist.

A buggy 260 is also shown in Fig. 49 having a ground-engaging wheeled frame 261 with spaced-apart pick-up arms 262 for engaging with the seat 250, as shown by means of bayonet connectors 265. Protective rails 264 retain a patient on the buggy 260 in use. The seat 250 is
20 also shown in Figs. 53 and 54. The rollers 291 on the base of the seat enable the seat to be moved easily on the seat pallet 292 (see Fig. 56) which has a number of lattices of grooves 293 with hollows at the intersections, which help to move the seat with patient in the direction chosen. The hollows help to control the speed of movement allowing for incremental steps of movement.

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Referring now to Fig. 55, there is shown a pedestal 270 for enabling a patient to be securely seated in the bathroom, shower, toilet, T.V. room, dining room and elsewhere. A patient is wheeled to the pedestal 270 on the buggy 260 and the seat is transferred from the buggy 260 to the pedestal 270 leaving the buggy 260 available for use with another patient. Two pick up
30 points 254 of the seat 250 are engaged with the bayonet connectors 265 on the pedestal 270.

- 15 -

Referring now to Fig. 57 and 58, a hoist 280 is shown comprising a ground-engaging wheeled base 281 with an upstanding mast 282 on the base 281 with a boom 283 pivoted on the mast 282. A ram 285 is operable to raise and lower the boom 283. A cradle 286 with four slings 289 are engagable with the seat 250. The hoist 280 enables a patient to be readily
5 easily transferred from the buggy 260 to a bath, shower, treatment couch or the like. The slings 289 to the front of the seat connect to two loops fitted to the two seat lifting points. The rear slings have two adaptors fitted between the lifting points 254 and pedestal locking mechanism. The seat cannot be disconnected from the buggy until the weight has been transferred to the pedestal. Arm rests can be used to provide comfort and security for the
10 patient while they are in the hoist 280.

Referring now to Figs. 59 and 63 there is shown another bed 300 which is largely similar to the beds described previously and like parts are assigned the same reference numerals. In this case the sub-frame 4 is mounted on the base frame 2 by means of independently collapsible
15 legs 301. Each leg 301 has a mounting bracket 303 slidably and rotatably mounted on an underside of the sub-frame 4 by means of a pair of spaced-apart hinge pins 304 which are slidable and rotatable in associated bushings 305 on the sub-frame 4. The mounting bracket 303 has an elongate slot 306. A strut 307 has a lower end 308 pivotally mounted on the base frame 2 and an upper end 309 which slidably engages the slot 306 by means of a sliding pin
20 310 at the upper end 309 of the strut 307. A cranked drive arm 312 is pivotally mounted intermediate its ends by a pivot pin 313 on the bracket 303. Outer ends 314, 315 of the drive arm 312 are pivotally connected intermediate the ends of the strut 307 and to a drive linkage 28 of the drive means. Operation of the drive means with the associated drive engage moves the strut 307 between a collapsed position as shown in Fig. 63 and an extended position as
25 shown in Fig. 62 for lowering or raising the sub-frame 4 and hence the patient support platform 3 on the base frame 2. The sizing of the linkages and arrangement of the slot 306 are such as to ensure substantially vertical movement. The hinge pins 304 allow pivoting of the sub-frame 4 about a longitudinal axis of the bed. It will be noted that the legs 301 on one side of the bed are also hinged at their lower end as described previously with reference to
30 Fig. 46 and 47 to allow tilting of the sub-frame 4 about a longitudinal axis of the bed.

- 16 -

The preferred drive mechanism for the operation of the bed 1 is shown in Figs. 64 to 80.

The drive means comprises a high torque reversible brake motor 20 mounted centrally between a pair of multi-cam drive housings 21. The motor 20 and housings 21 are mounted at one end of the sub-frame 4. The motor 20 is connected to drive shafts 23 extending centrally through each housing 21 for co-operation with a plurality of drive mechanisms 25 mounted within each housing 21. A drive mechanism 25 is shown in detail in Figs. 67 to 79. Each drive mechanism 25 is operable to engage with or disengage from the drive shaft 23. Each drive mechanism 25 includes a linear actuator 26 which is pivotable upon engagement of the drive mechanism 25 to operate an associated drive linkage connecting each drive mechanism 25 with an associated panel 5, 6, 8 and 9 for movement of the panels 5, 6, 8 and 9 on the sub-frame 4.

Each drive mechanism 25 is attached to a fixed plate 30 through which the drive shafts 23 extends through all the units. The drive linkages 28 are connected to the linear actuators 26 by bolts not shown located in one of holes 31 at ends 32. At the other end 33 of each linear actuator 26 is a hole 34 for the shaft 23. Beneath hole 34 is a slot 35 which accommodates a selector 36 which is linearly movable by a spring loaded solenoid 37. At either side of selector 36 are housings 40, 41, one for a brake engaging block 42 and driving block 43. Fixed to the shaft 23 is a drive gear 50, and a braking gear 60 shown only in Fig. 66. Each selector block 36 has a "boomerang" shaped slot 38, 39 at either side of the block. One slot 38 is the reverse of the other slot 39 so as to give alternative motion and overlapping common positions for the brake and drive to ensure that the linear actuator 26 is controlled either by the drive motion or brake mechanism. Transfer between the braking and driving modes occurs without the linear actuator 26 ever being in a neutral or free movement mode.

Each brake block 42 and drive block 43 has a pin 51 which is engaged in a slot 38 or slot 39.

The operation of the drive mechanism 25 is shown in Figs. 70-72. In Fig. 70, the brake is off (i.e. disengaged) and the drive is on (i.e. engaged), in that the drive block 43 is engaged with gear 50 and the brake block 42 is seated in the housing 40. In Fig. 71, both the brake and

- 17 -

drive are on as the pins 51 of the blocks 42 and 43 are in the common position in the slots 38, 39. In Fig. 72, the drive is off and the brake is on. In going in the reverse direction from full brake to full drive the sequence is the opposite and goes from Fig. 72 to 71 to 70. The maximum range of travel of the linear actuator 26 relative to the gear wheel 40 is shown in
5 Figs. 73 and 74. Fig. 75 shows in dotted view the position of the drive block 43 in the two extreme positions.

A sensor is provided on the drive mechanism to ensure that when the mechanism stops, the teeth of the brake block 42 or the drive block 43 engages directly onto the gear teeth of the
10 gears 50 and 60.

Fig. 80 illustrates the eight different positions which the mechanism 25 can adopt. In position one shown in Fig. 80, the solenoid is off, the cam brake is on, the drive is off, the drive shaft is free to drive a further gear 50 and the linear actuator 26 is locked. The
15 mechanism then goes through the sequence indicated until position nine which is a repeat of position one.

It will be appreciated that the invention provides a bed particularly a therapeutic bed which facilitates patient comfort and movement of a patient into and out of a bed. Further, the
20 invention also provides an overall patient handling system for transporting, seating and lifting patients and drive mechanism for the operation of the bed.

It will of course be understood that the invention is not limited to the specific details described herein, which are given by way of example only, and that various modifications
25 and alterations are possible within the scope of the invention as defined in the appended claims.

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(1)

CLAIMS

1. A bed (1) comprising a base frame (2); a patient support platform (3) on the base frame (2), the patient support platform (3) being moveable on the base frame (2); platform drive means for movement of the platform (3) on the base frame (2); characterised in that the base frame (2) supports a central panel (5) for supporting the patient's bottom, a second panel (8) and a third panel (9) for supporting the upper and lower parts, respectively, of the patient's legs and a fourth panel (6) for supporting the patient's back, there being drive means for displacing the panels such that in one configuration their upper surfaces lie in a single horizontal plane and in another configuration adjacent panels are inclined with respect to each other, the bed (1) further comprising a leg support (12) which is displaceable into and out of a position in which it forms a local widening of the bed, in which position it can support the lower parts of the patient's legs when the patient is in an attitude in which the legs are straight or are bent and the patient is lying on his side; a patient support (250) having a seat portion and a back portion, the patient support (250) being supported by the bed (11), such that when the patient is in said attitude said seat portion may be interposed between the patient's bottom and upper parts of the legs, on the one hand, and the second panel (8) when upright, on the other

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AMENDED SHEET

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02-JUL-1998 14:58 FROM F.R. Kelly, Ireland. MF TO 0014169419443 P.30/33

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hand, with the back portion of the patient support
(250) adjacent the patient's back, and the fourth panel
(6) may be brought upright by said drive means to cause
the patient to adopt a sitting position on the patient
5 support (250).

2. A bed (1) as claimed in Claim 1 characterised by
means whereby the fourth panel (6) can be brought into
a position in which its upper surface is parallel to,
10 but in a higher plane than, the upper surface of the
central panel (5).

3. A bed (1) as claimed in Claim 1 or 2 characterised
in that there are means for interlocking the central
15 panel (5) and the fourth panel (6), whereby they may be
pivoted together to bring the fourth panel (6) upright.

4. A bed (1) as claimed in any of Claims 1-3
characterised in that the leg support (12) is pivotally
20 mounted on the fourth panel (6).

5. A bed (1) as claimed in Claim 4, characterised in
that the pivotal mounting of the leg support (12) is
effected by two arcuate rods (13) fixed to the leg
25 support (12) and extending into tubes (14) fixed to the
fourth panel (6).

6. A bed as claimed in Claims 4 and 5 in which the
leg support (12) is movable simultaneously with the

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353 1 668 2844 PAGE.030

AMENDED SHEET

02-JUL-1998 14:58 FROM F.R. Kelly, Ireland. MF TO 0014169419443 P.31/33

means for movement of the panels (5,6,8,9) on the sub-frame (4), the second panel (8) and the third panel (9) are hingedly interconnected for relative movement of the panels (8,9) between an in-line flat position and an angled position, the panel (8) being pivotally movable relative to the central panel (5), the panels (5, 6, 8 and 9) being operable to be in alignment to define a horizontal position, the panel drive means being operable to raise and lower the fourth panel (6) in a torso mode, in a first pre-set position and raise and lower the fourth panel (6) in an inclined position in a second pre-set position with means being provided to secure the fourth panel (6) in the torso or back-rest positions, the patient support platform (3) being tiltable about a transverse axis so as to assist in turning a patient onto his side, the fourth panel (6) being operable to be raised and locked in the torso mode to form a stepped configuration with the central panel, the second panel (8) is pivotable upwardly into a generally vertical position with the third panel (9) being pivotable relative to the second panel (8) to lie into an inclined position, whereby the patient support (250) may be placed in position behind the patient with a seat portion resting between the patient and the second panel (8) and a back portion extending upwardly along the patient's back, and with the interlocked fourth panel (6) and central panel (5) being operable to be pivoted upwardly on the sub-frame (4) into an upright position whereby the patient is brought into a

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JUL 02 '98 10:03

353 1 668 2844 PAGE.031

1997

7. A bed as claimed in Claims 4, 5 and 6 in which the leg support (12) rotates with the fourth panel (6) when said fourth panel (6) is pivoted upwardly on the sub-frame (4) into an upright position.

8. A bed (1) as claimed in any of Claims 1-7, characterised by the patient support (250) being in an upright position and engaged with a buggy (260) for transporting the patient support (250) away from the bed.

9. A bed (1) as claimed in any of Claims 1-8, characterised in that each panel (5, 6, 8 and 9) consists of a rigid panel base (5', 6', 8' or 9') and a portion of mattress laid on it, these portions being provided by one mattress on the panel bases (5', 8' and 9') of the central panel (5), the second panel (8) and the third panel (9) and another mattress on the panel base (6') of the fourth panel (6).

10. A bed (1) as claimed in any of Claims 1-9 wherein the patient support platform (3) comprises a sub-frame (4) with the plurality of said panels (5,6,8,9) being movable on the sub-frame (4), and panel drive

ANNEXED SHEET

02-JUL-1998 14:59 FROM F.R. Kelly, Ireland. MF TO 0014169419443 P.33/33

seated position at the side of the bed (1) through the lifting action of the bed.

11. A bed (11) as claimed in any of Claims 1-10
5 wherein the leg support (12) is mounted at a side of the patient support platform (13), the leg support (12) being movable between a stored position underneath the patient support platform (3) and an engaged position extending outwardly of the patient support (250).
- 10
12. A bed as claimed in Claim 11 in which the leg support (12) is mounted on the fourth panel (6), whereby when the patient is arranged on the patient support (250) with the upper body of the patient on the
15 fourth panel (6), the upper legs of the patient are bent so that they extend outwardly over the leg support (12) which is first movable simultaneously and second rotatable simultaneously with the fourth panel (6).

1/30

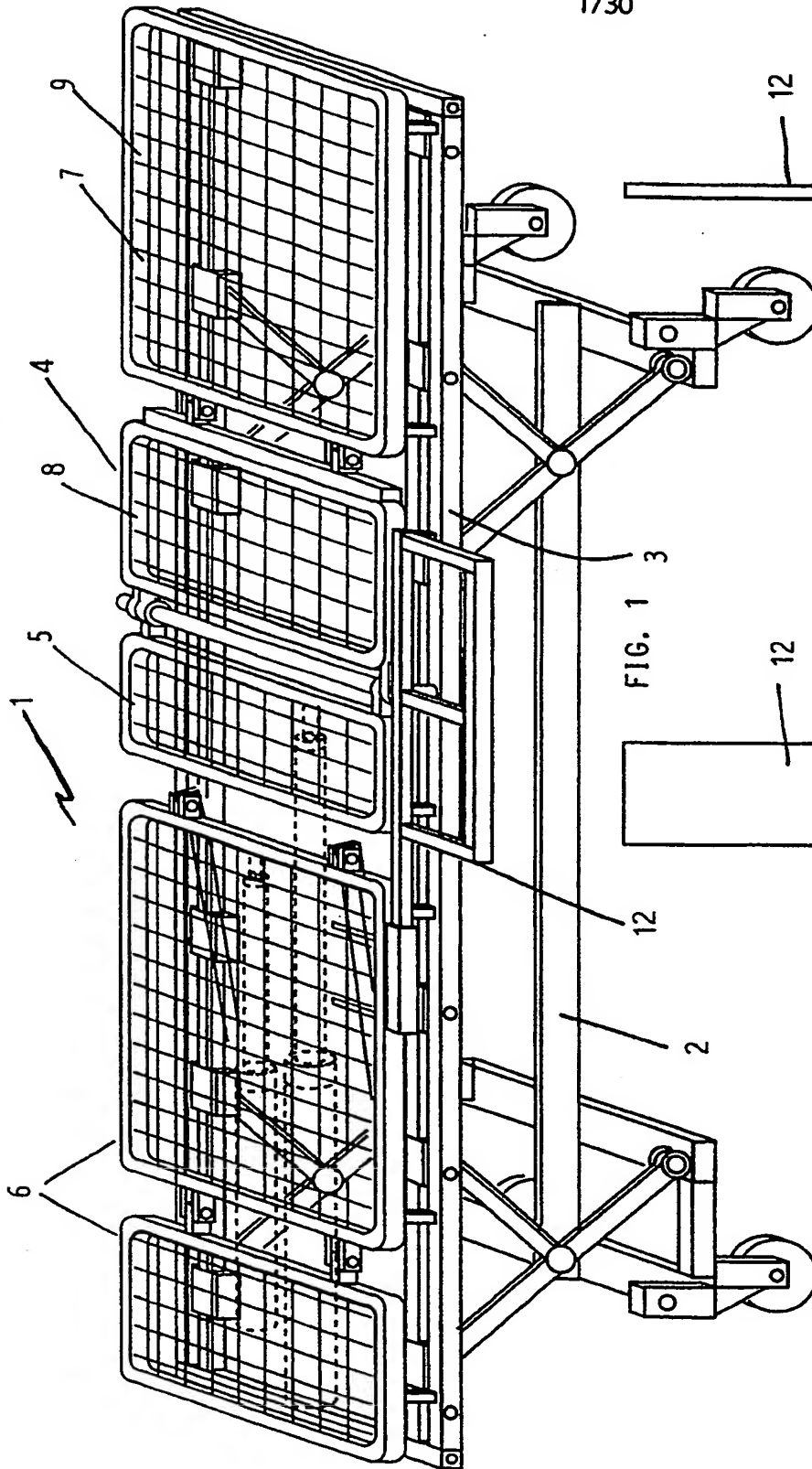


FIG. 1

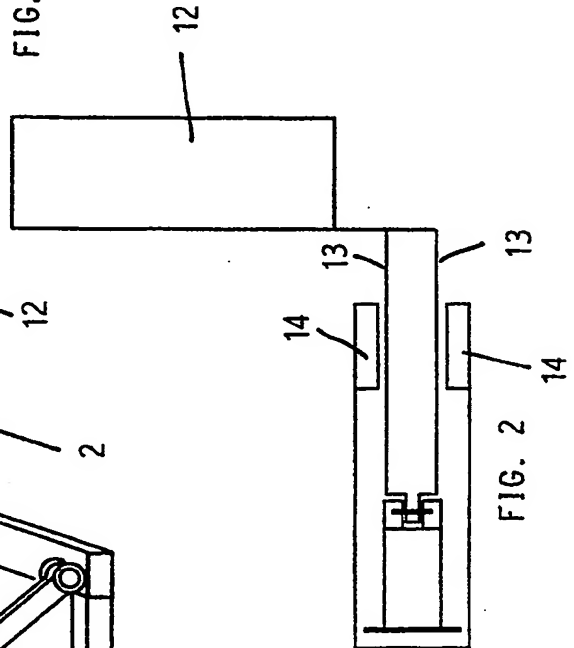


FIG. 2

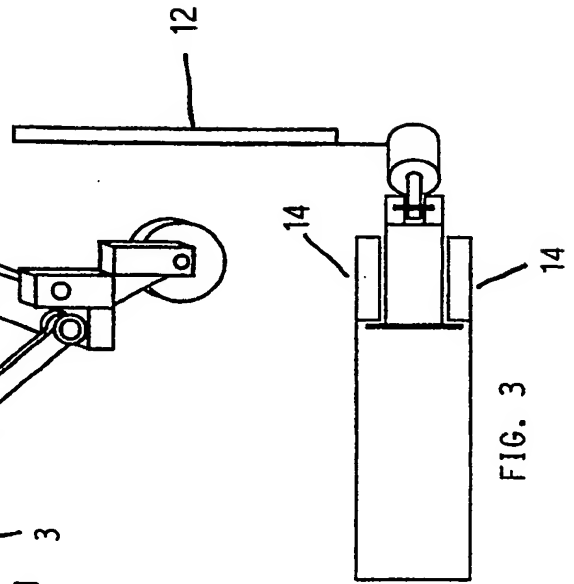
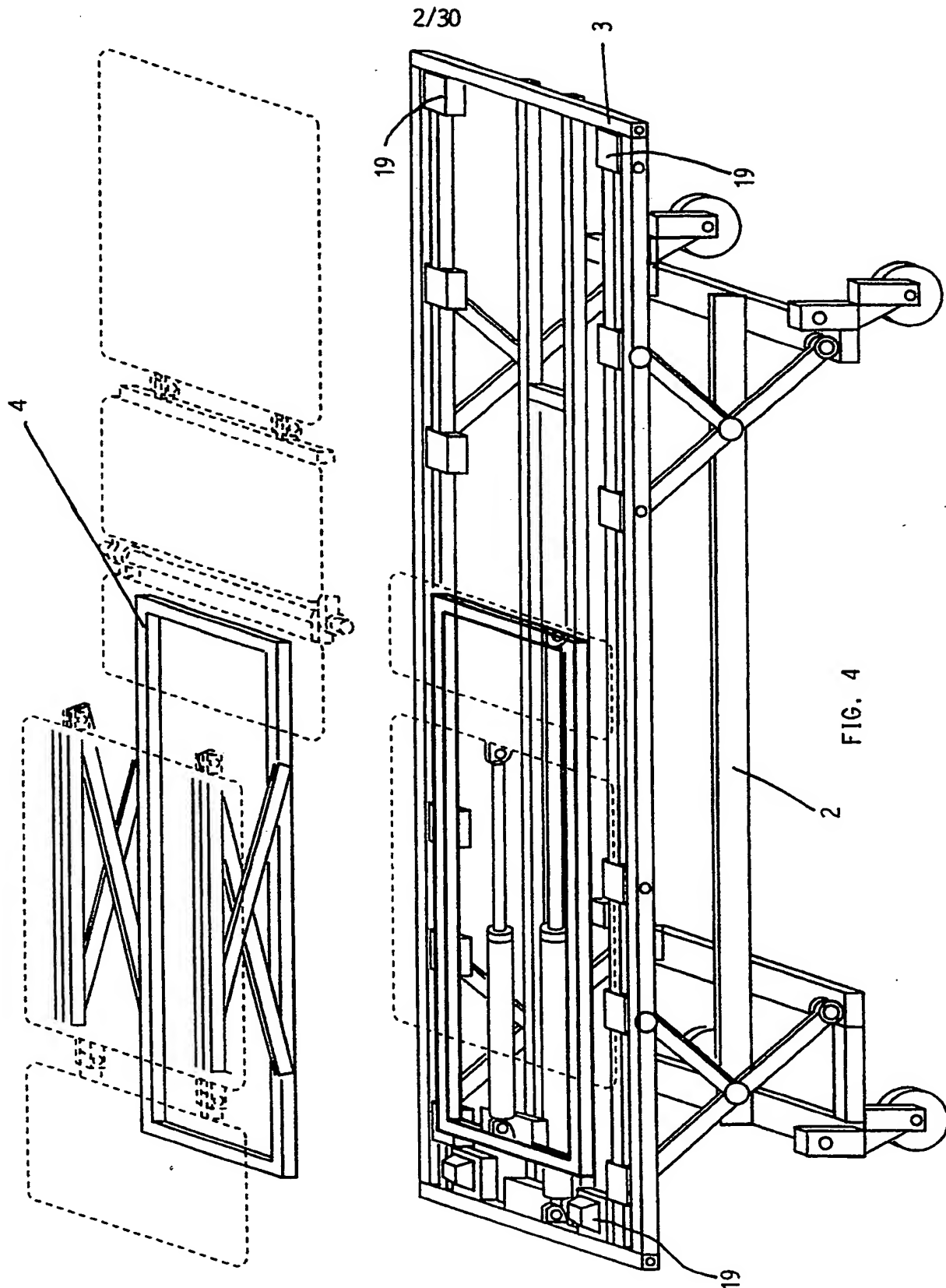
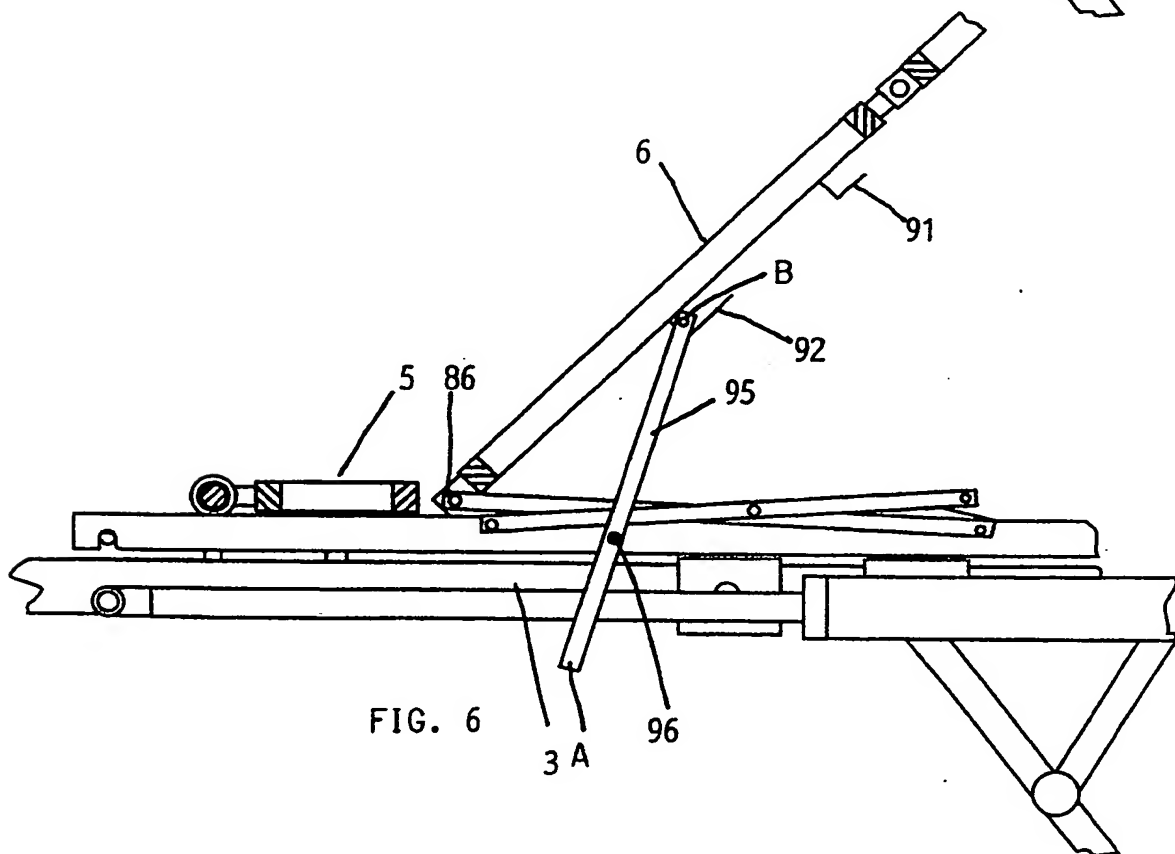
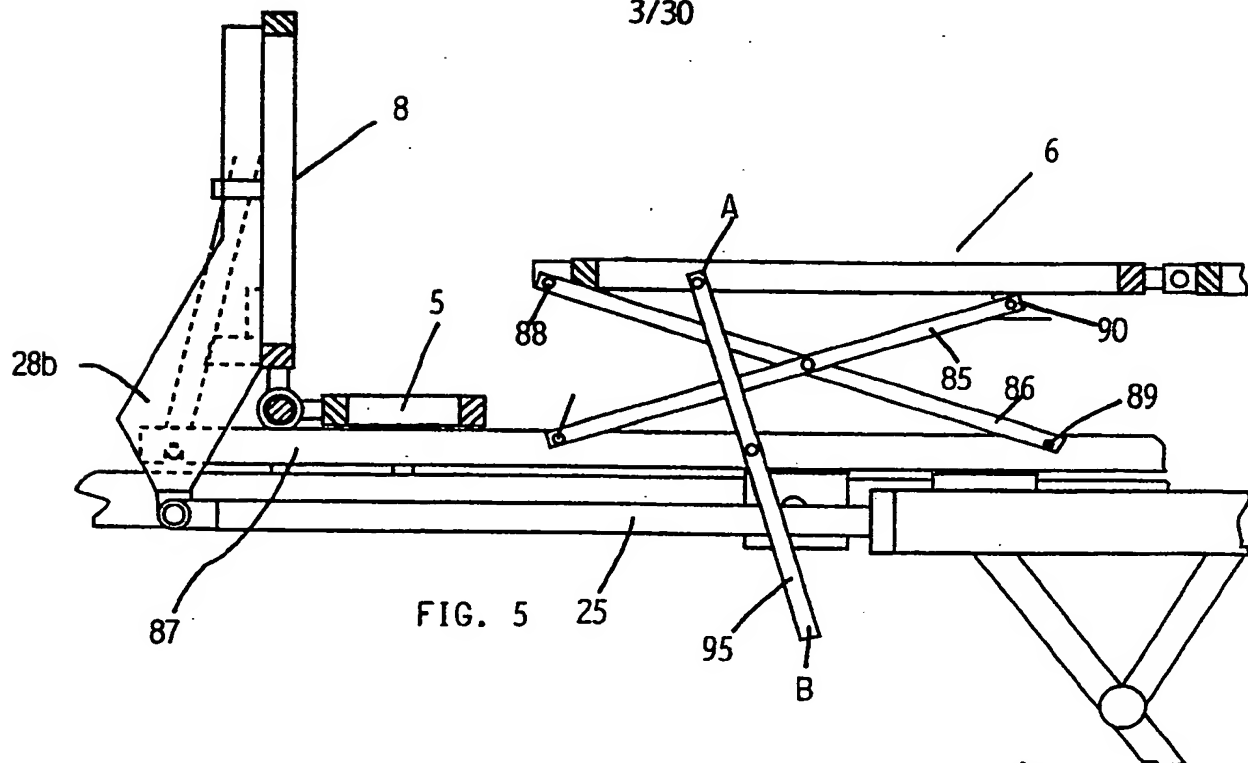
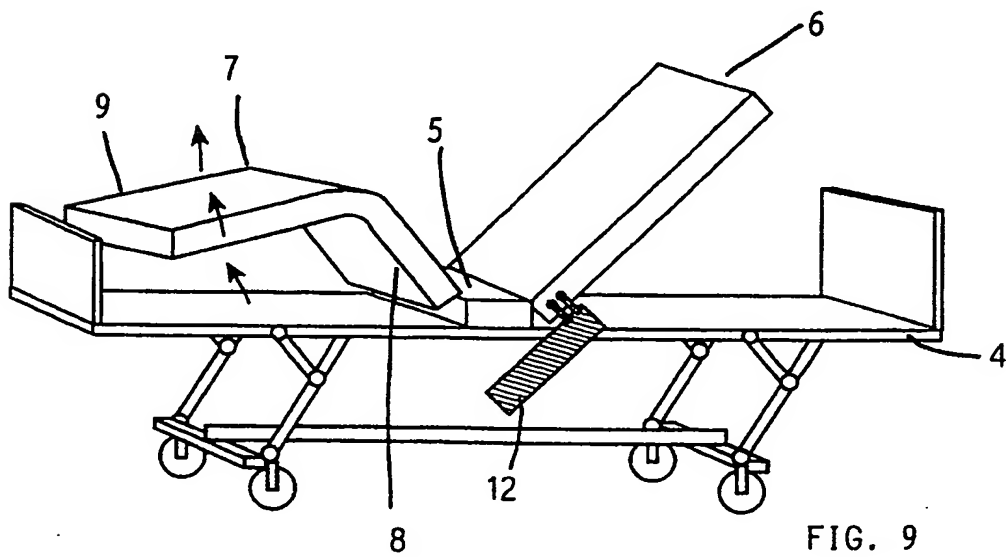
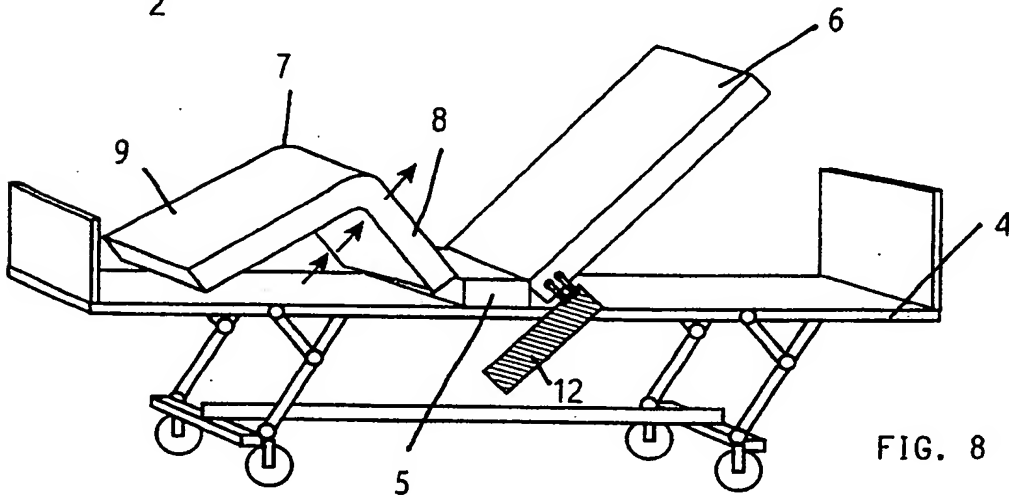
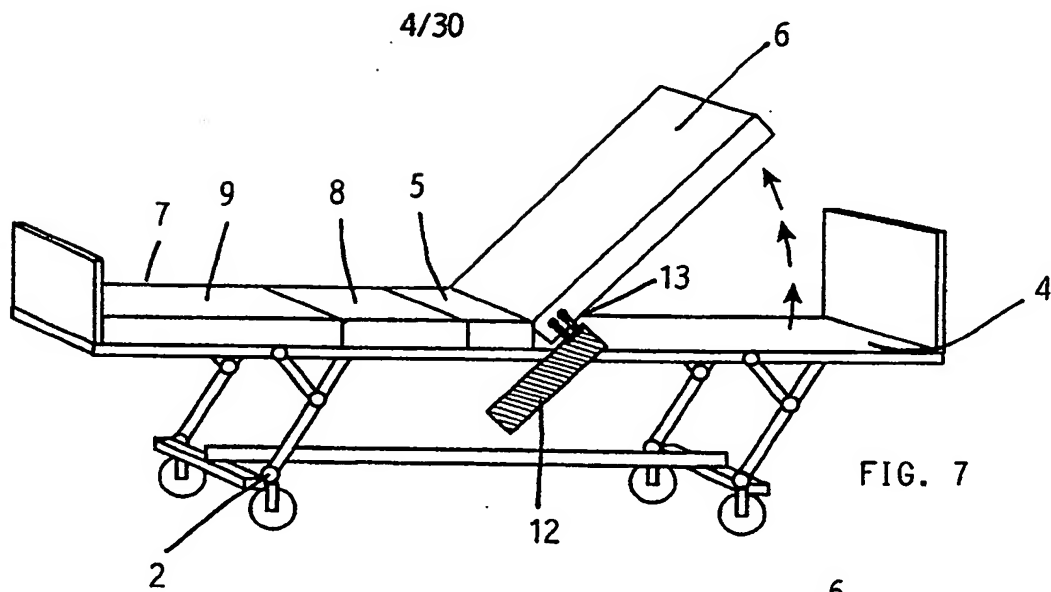


FIG. 3



3/30





5/30

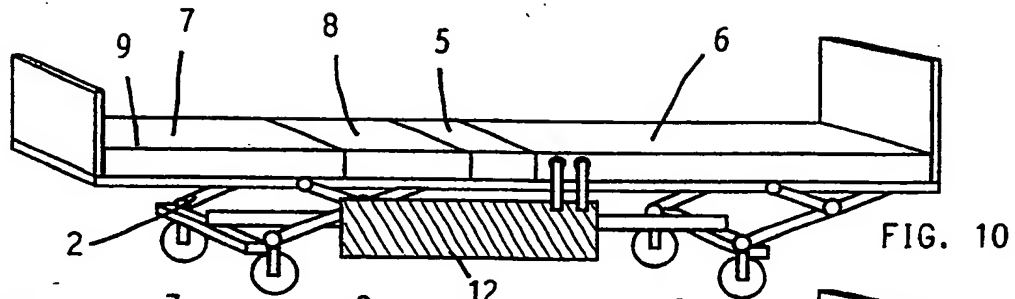


FIG. 10

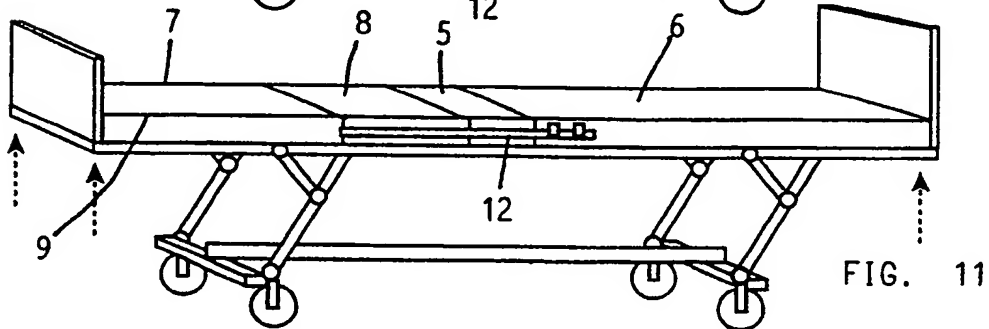


FIG. 11

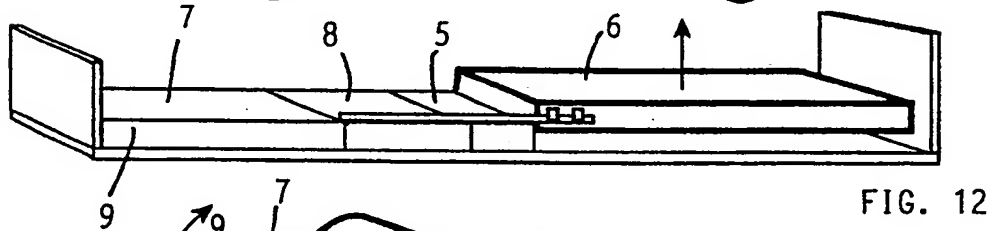


FIG. 12

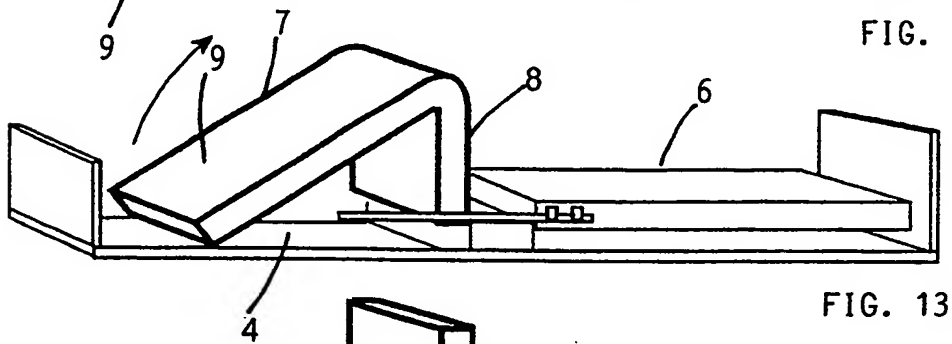


FIG. 13

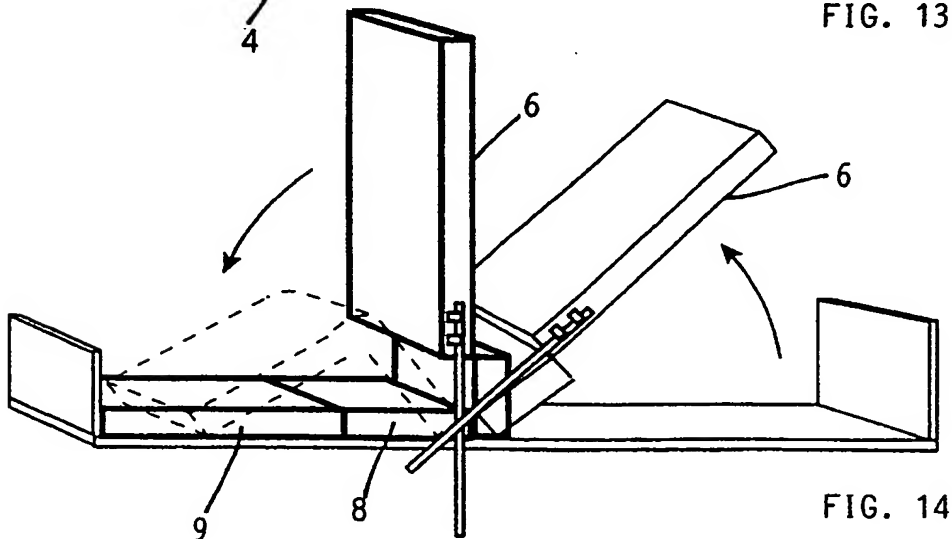
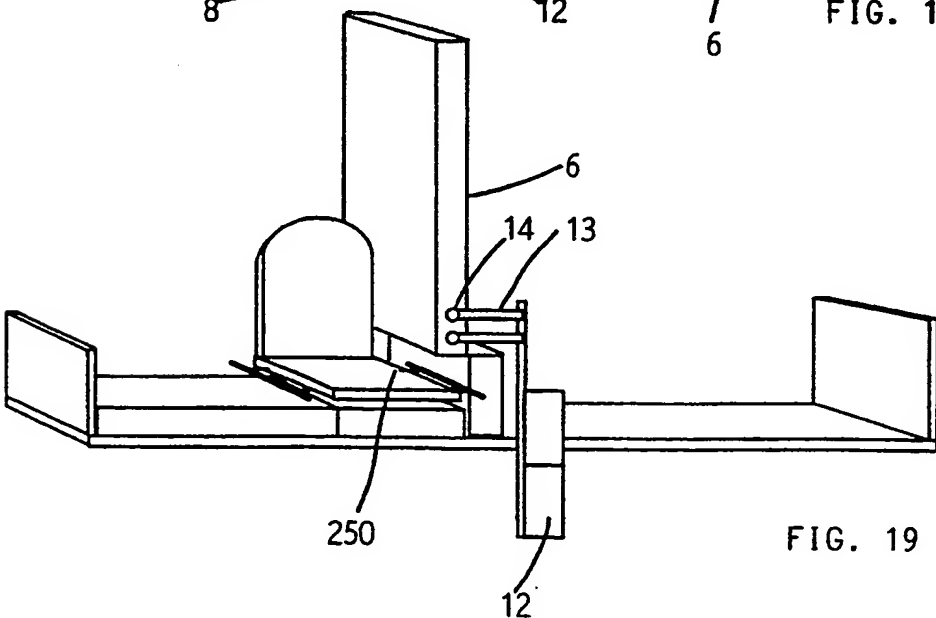
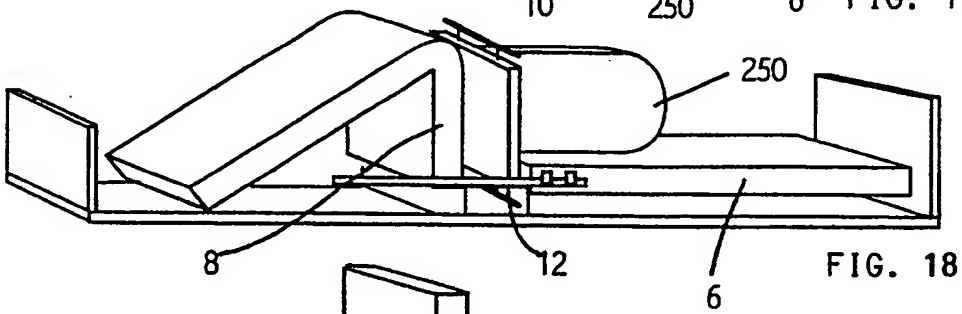
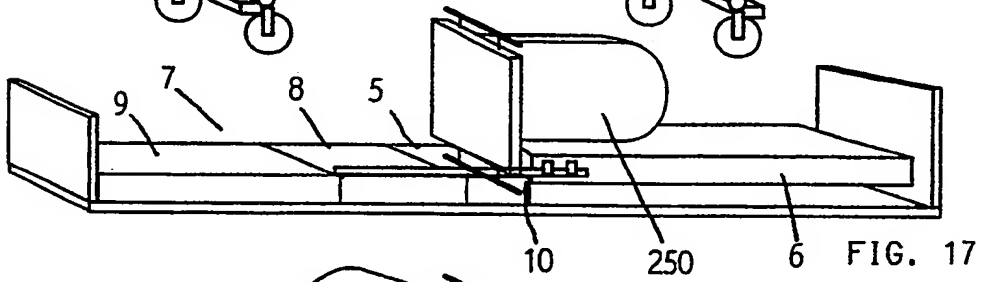
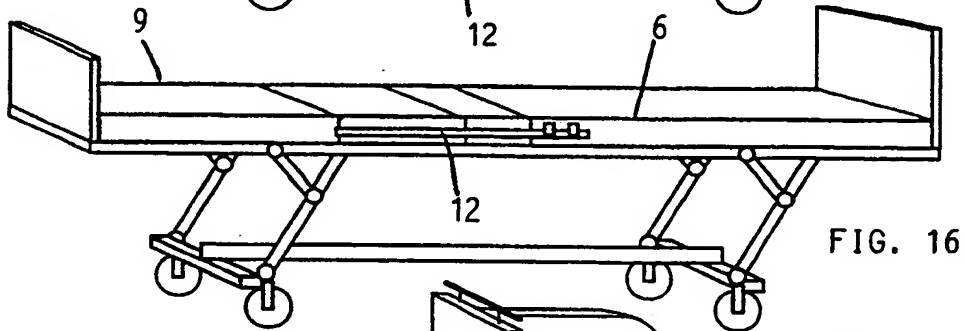
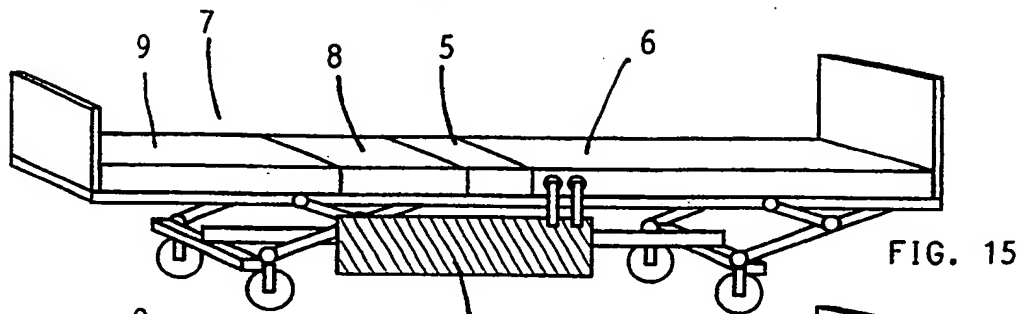
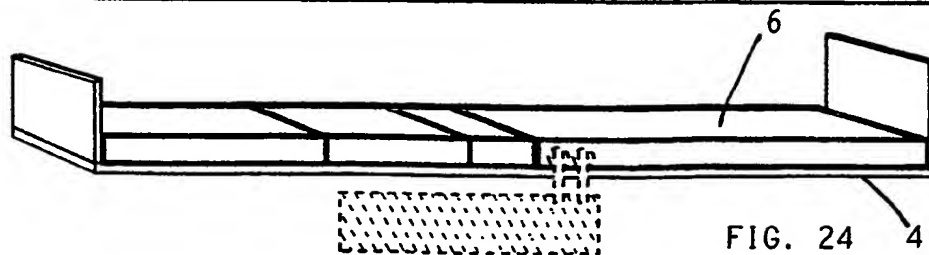
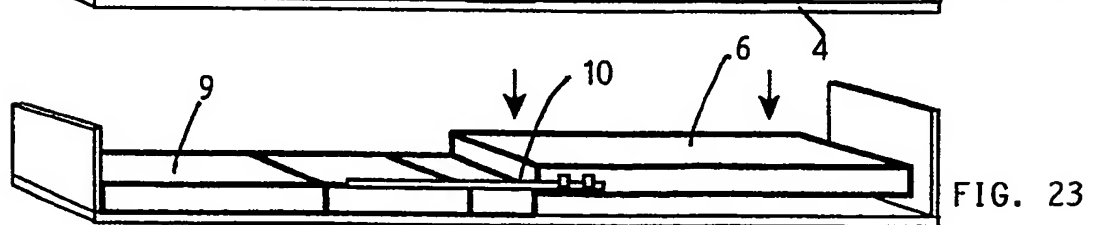
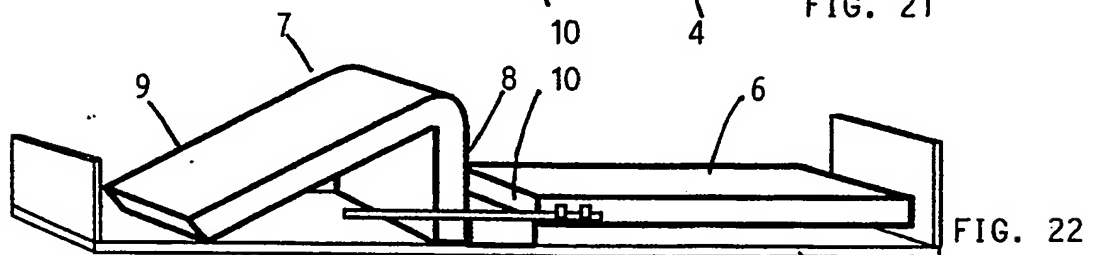
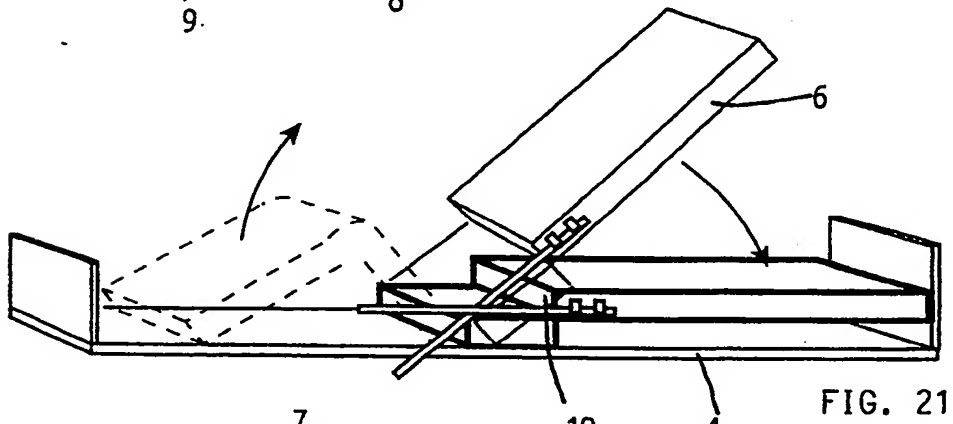
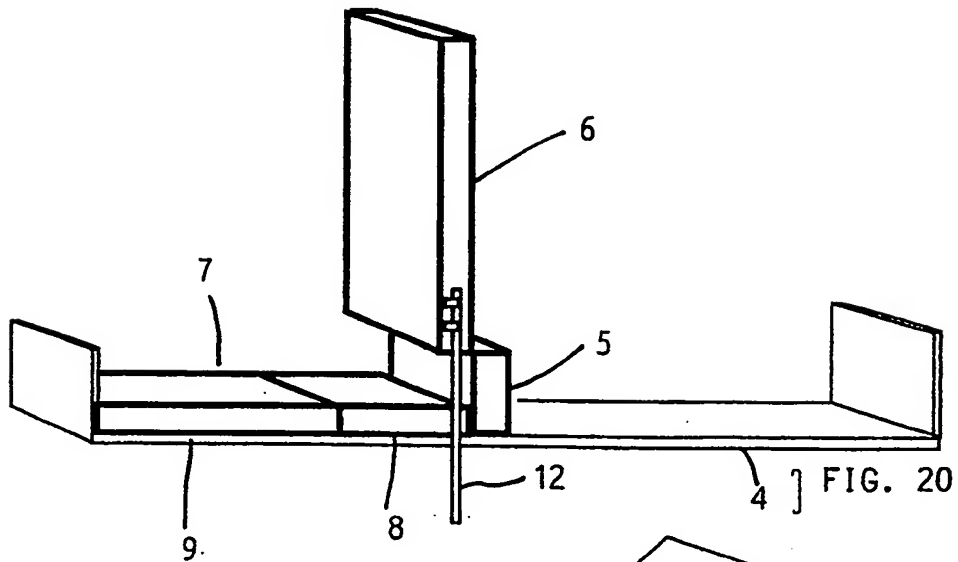


FIG. 14

6/30



7/30



8/30

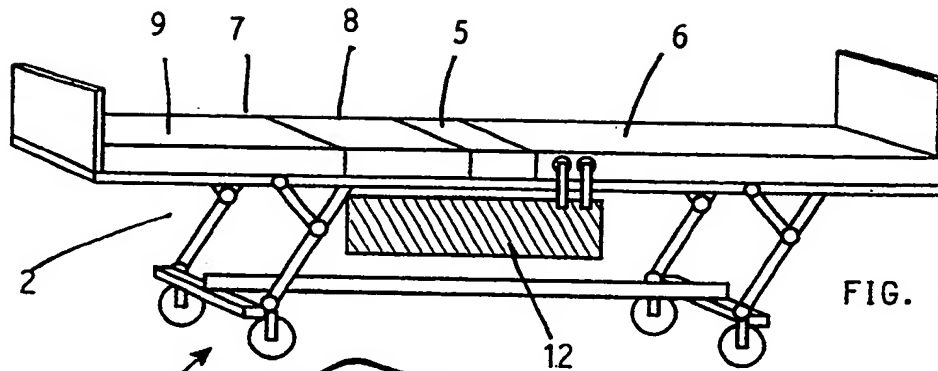


FIG. 25

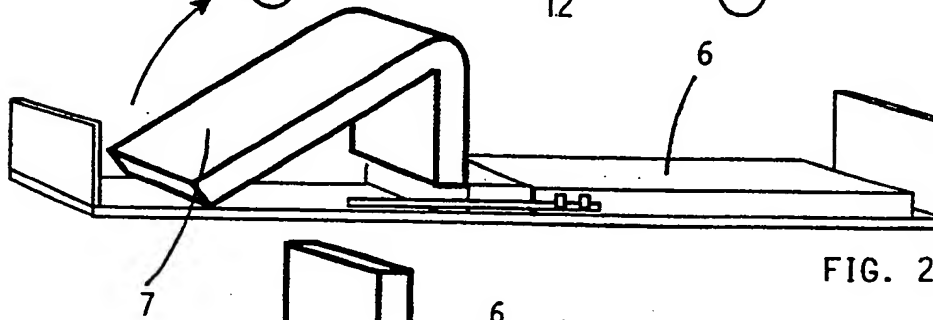


FIG. 26

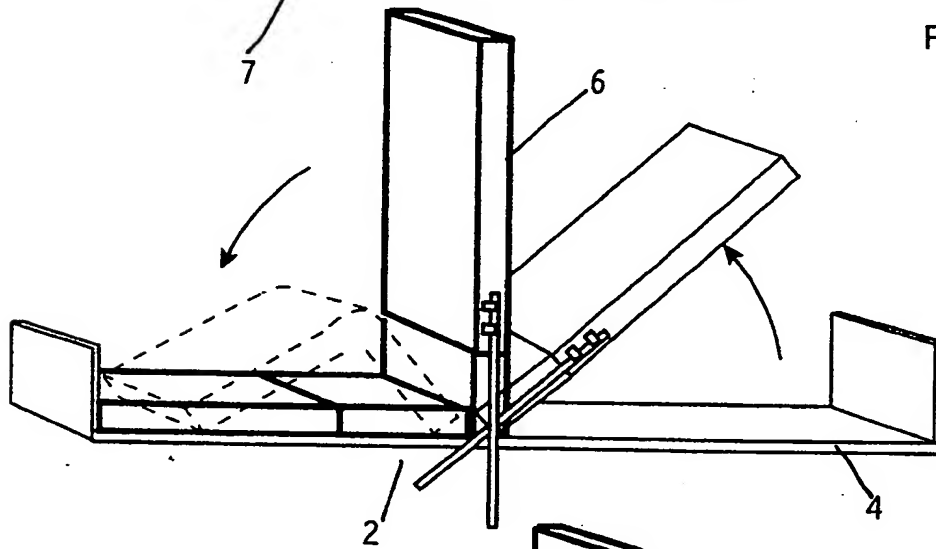


FIG. 27

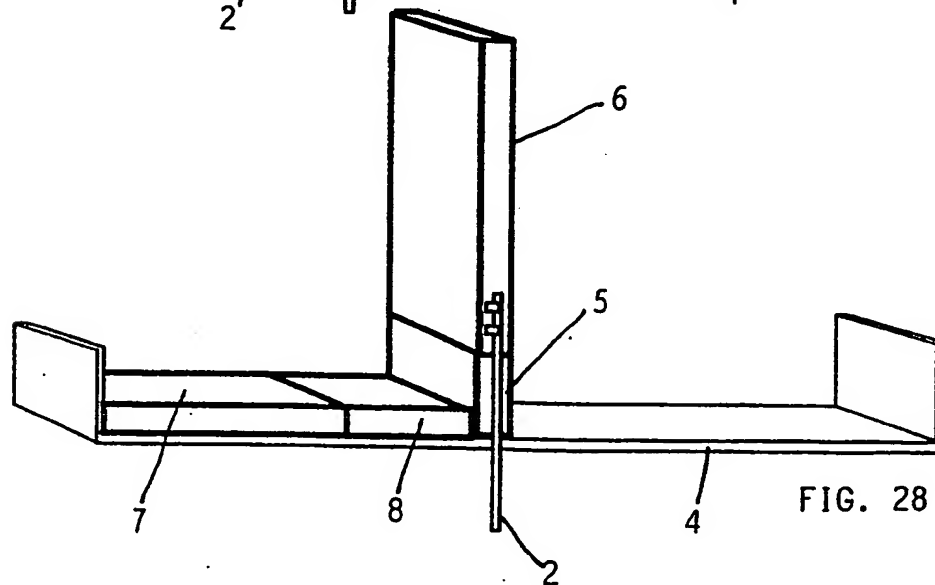


FIG. 28

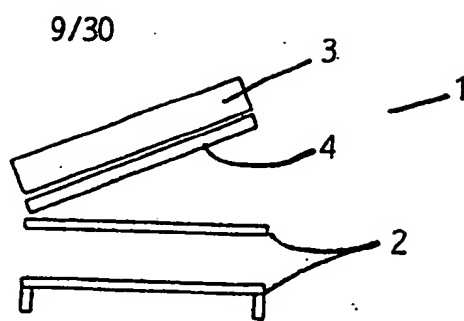


FIG. 29

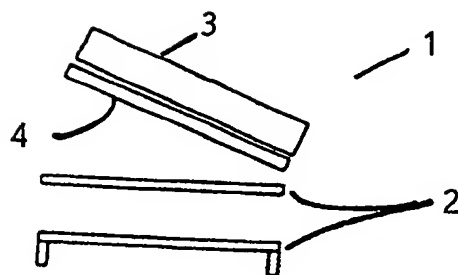


FIG. 30

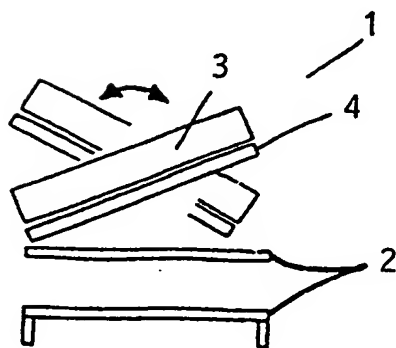


FIG. 31

10/30

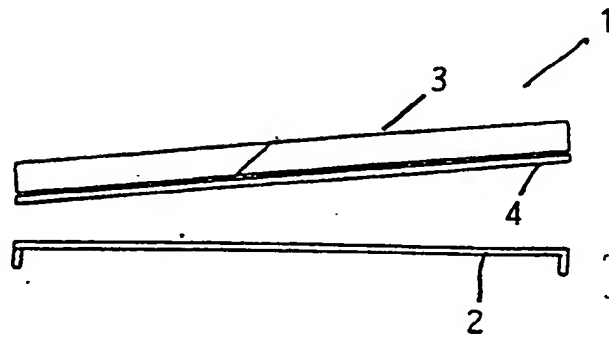


FIG. 32

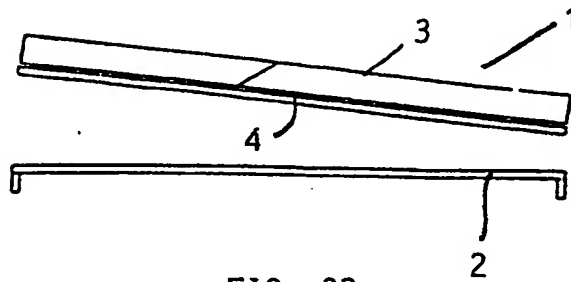


FIG. 33

11/30

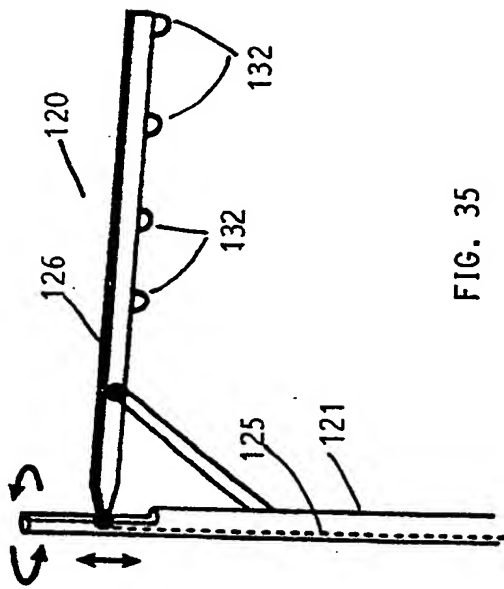


FIG. 35

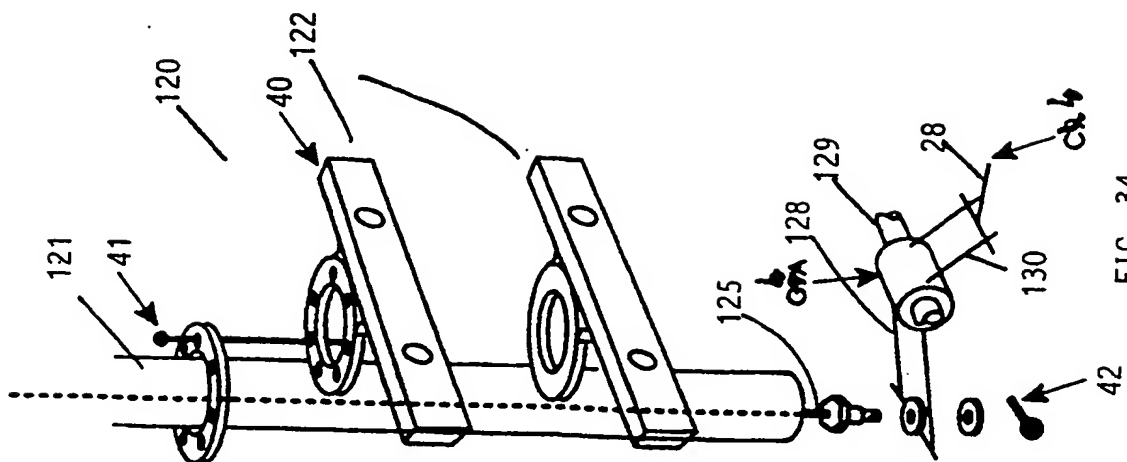
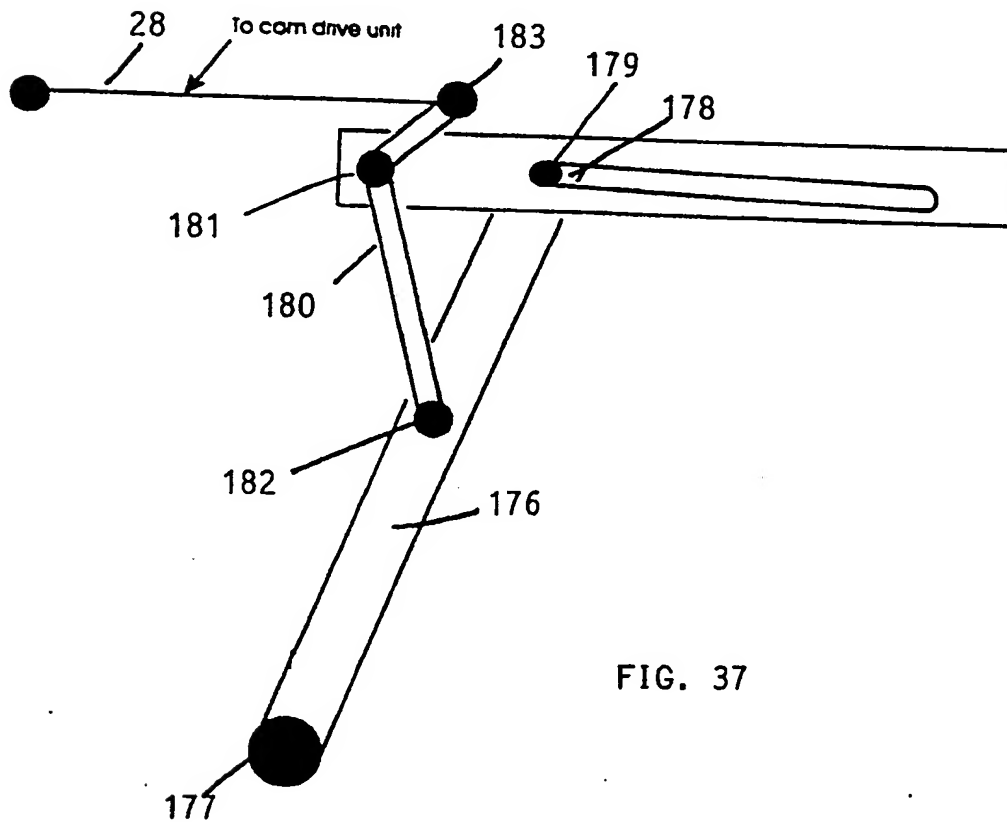
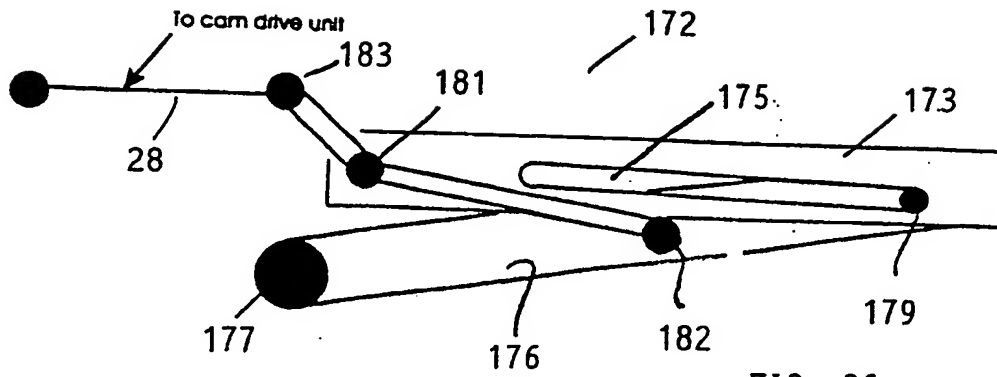


FIG. 34

12/30



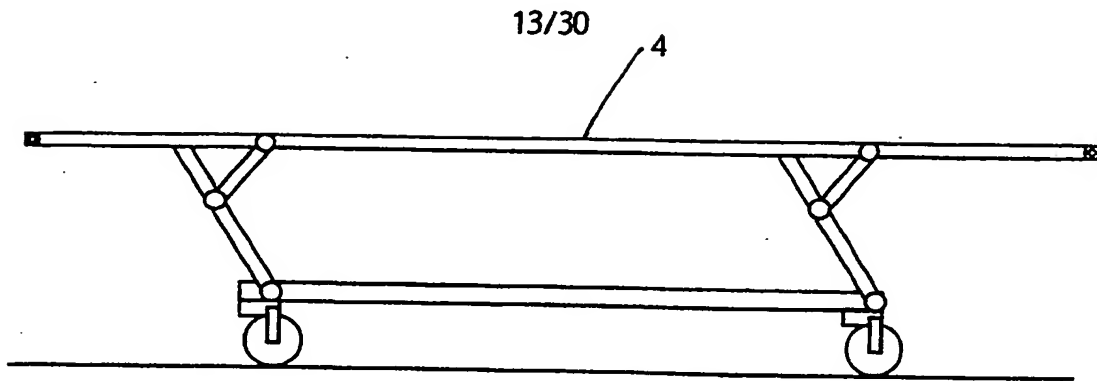


FIG. 38

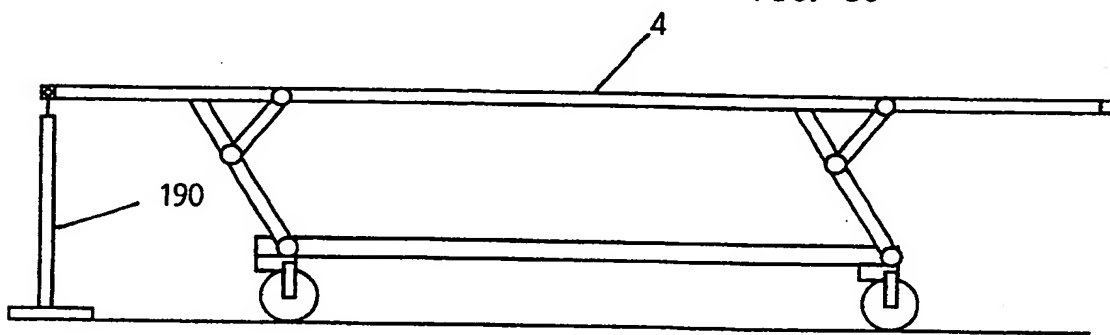


FIG. 39

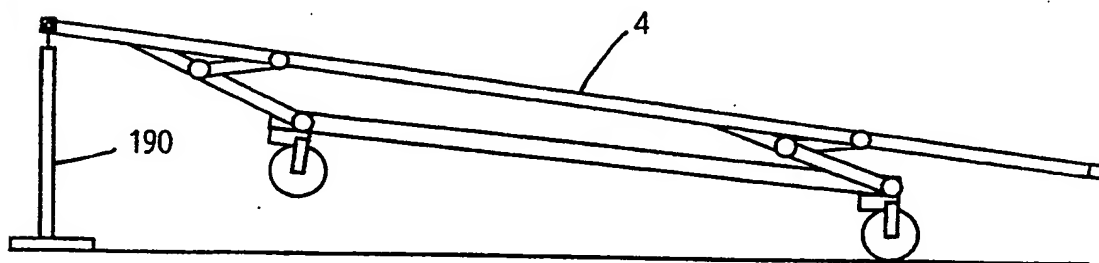


FIG. 40

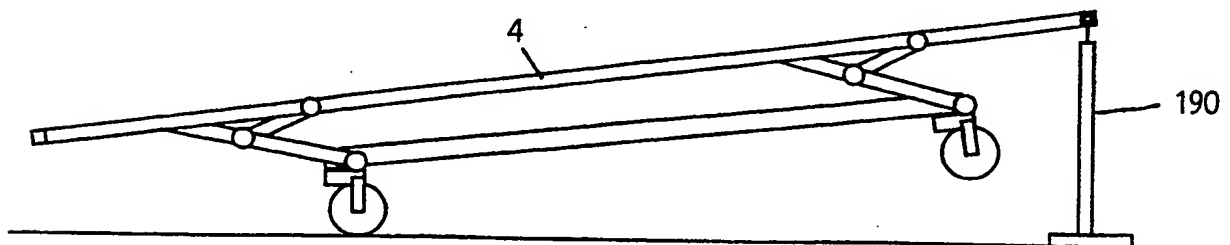
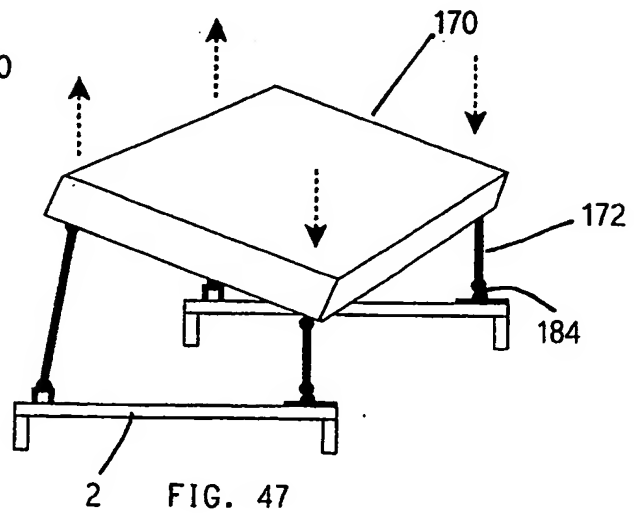
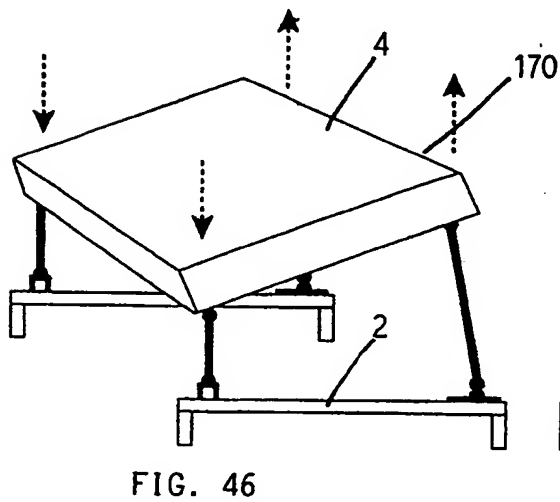
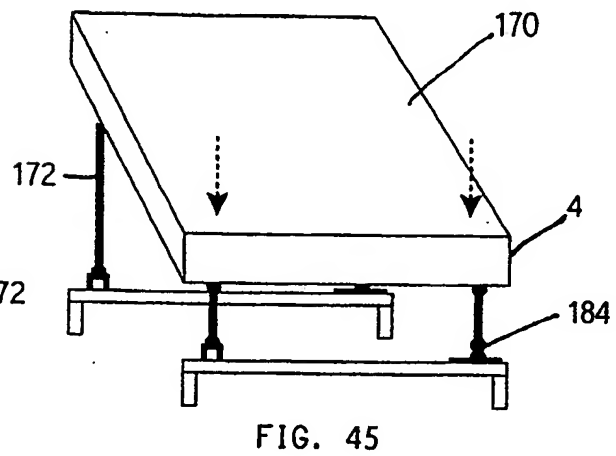
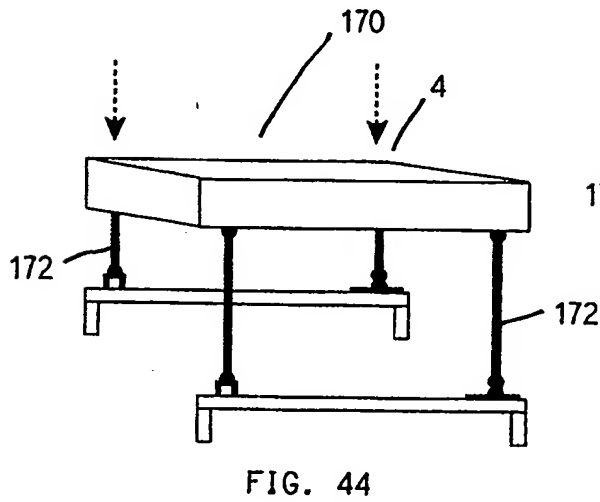
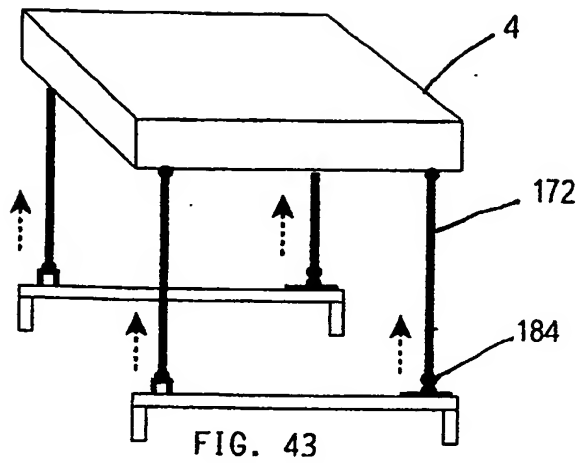
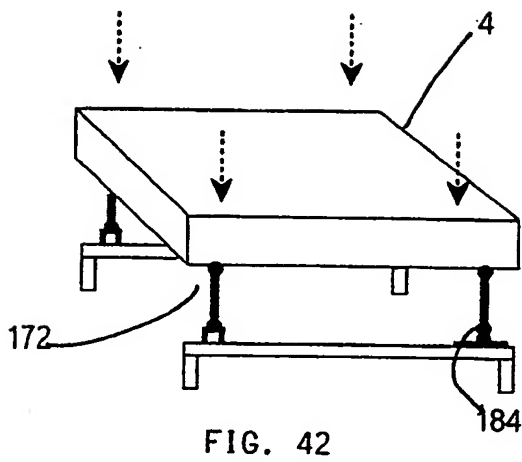


FIG. 41

14/30



15/30

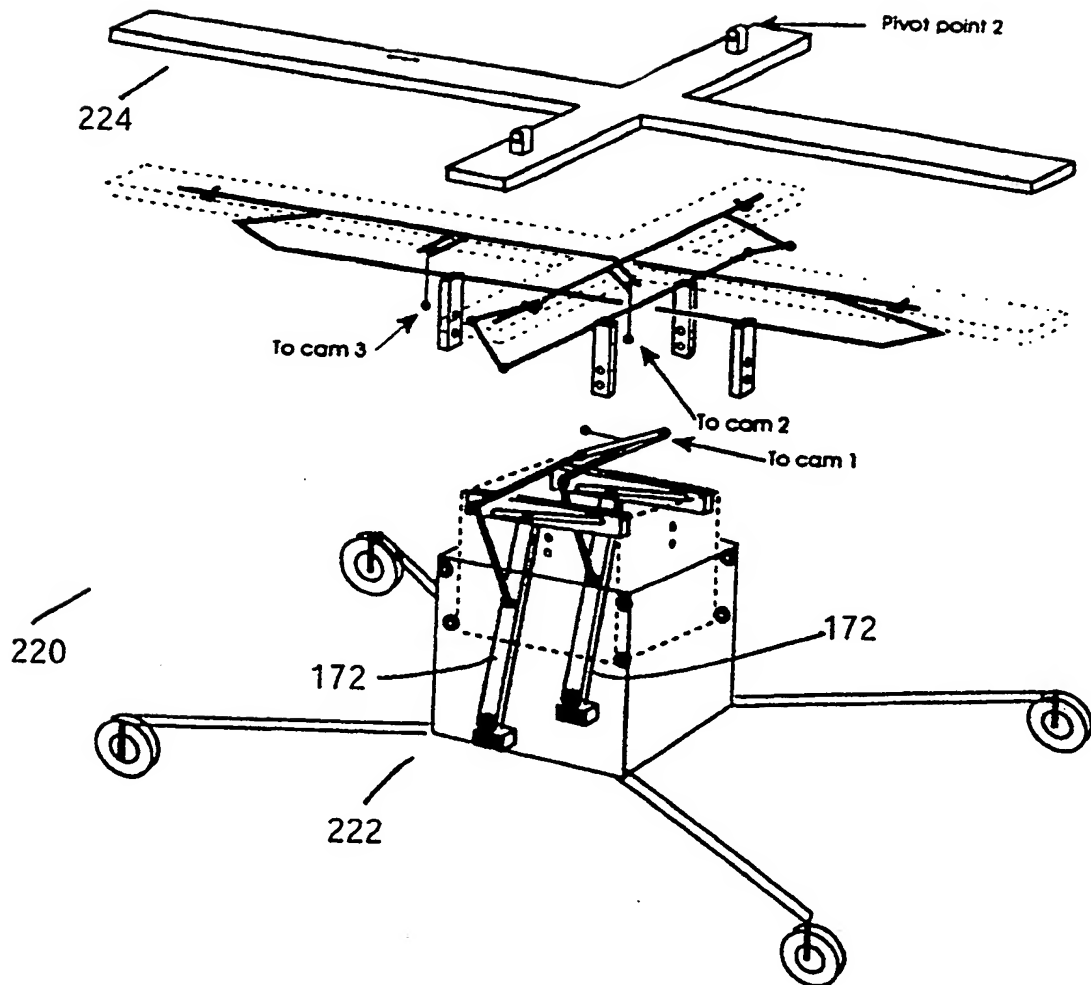
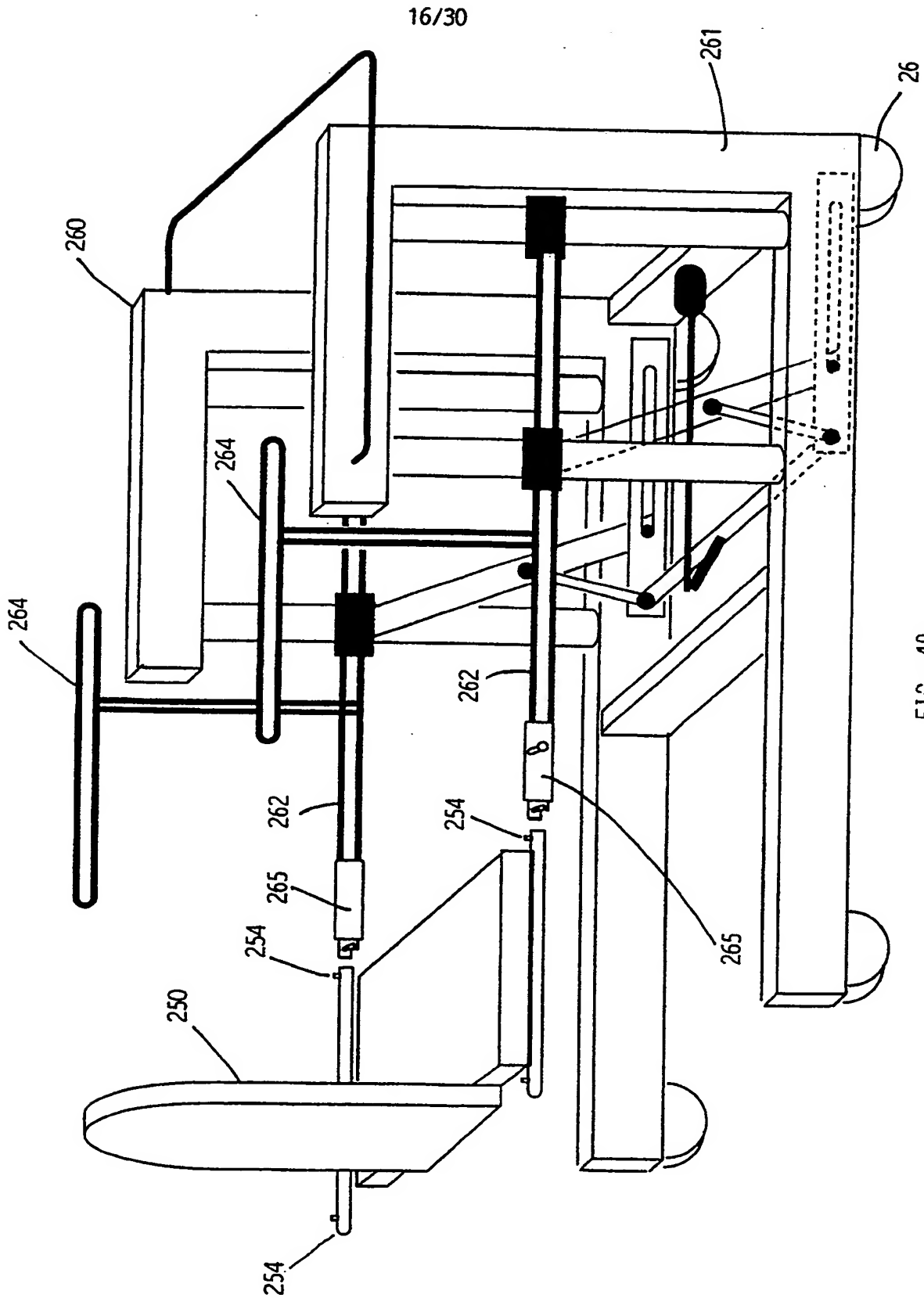
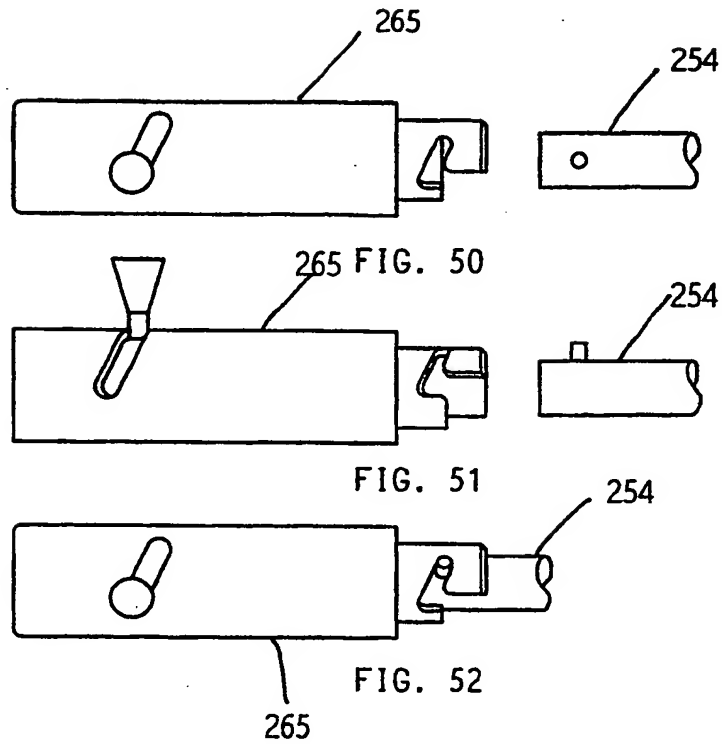


FIG. 48



17/30



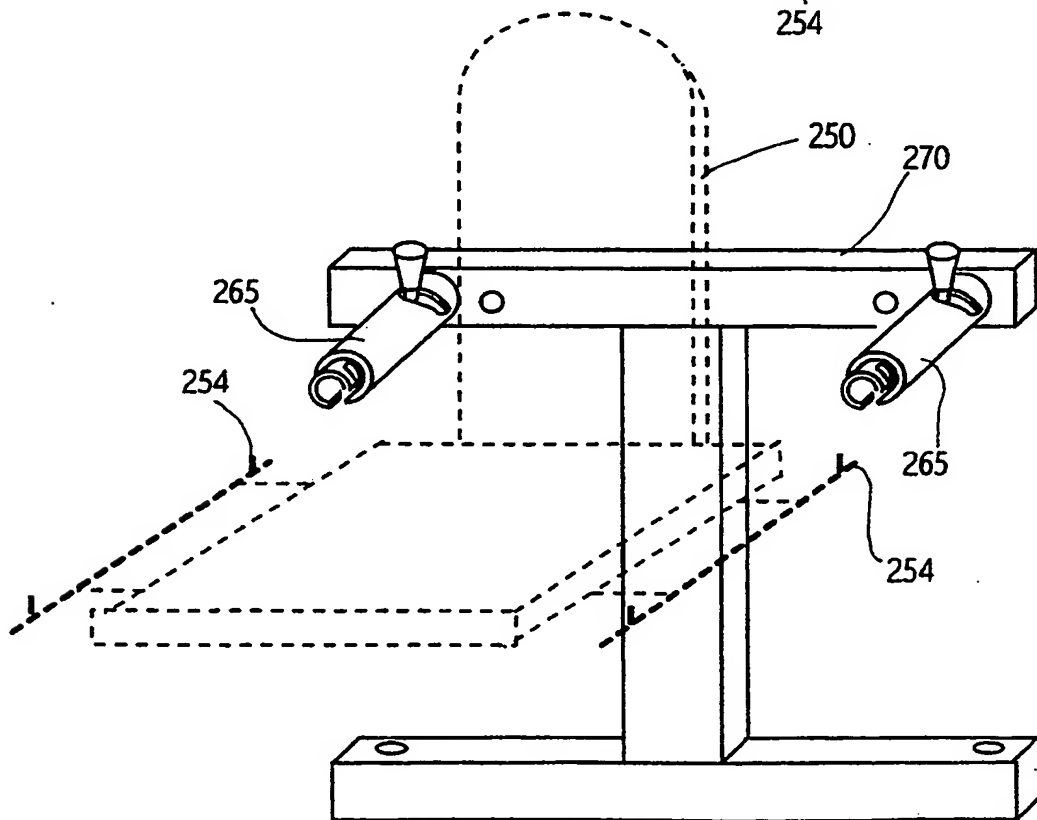
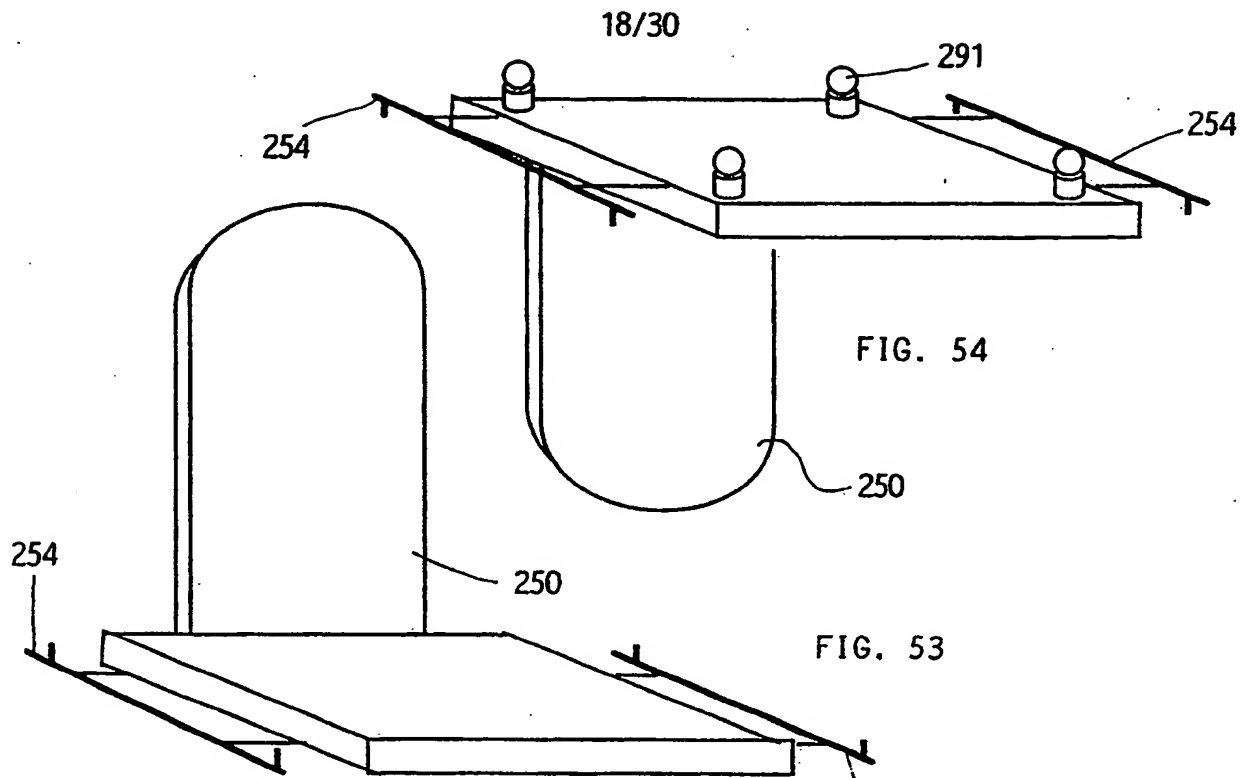


FIG. 55

19/30

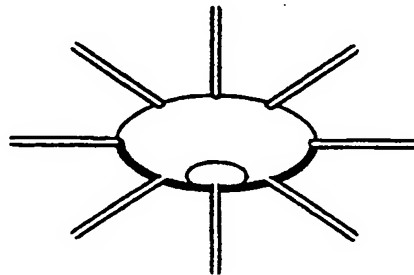
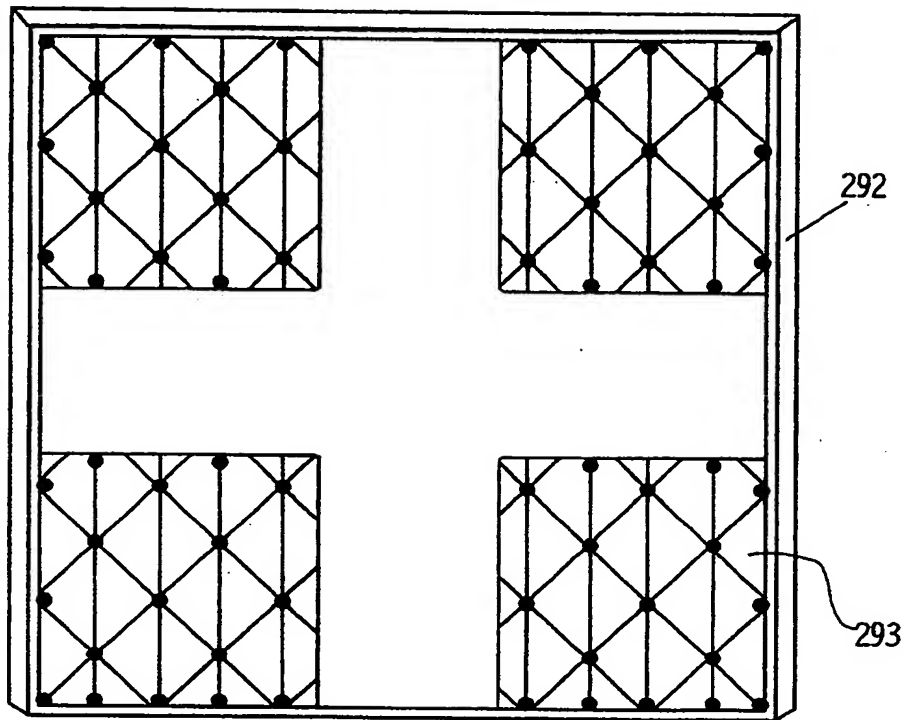
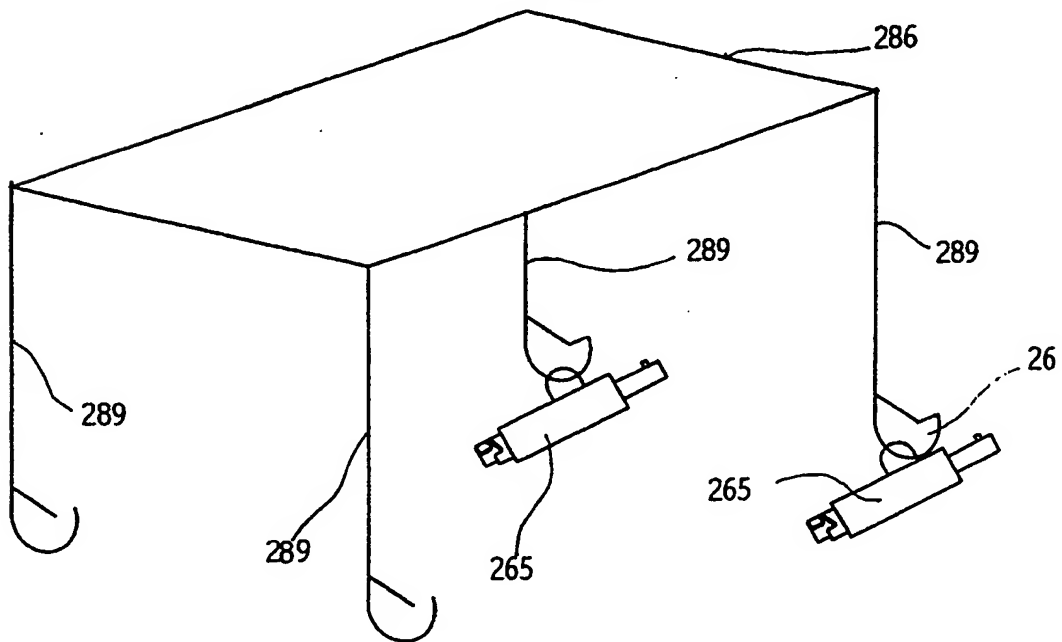
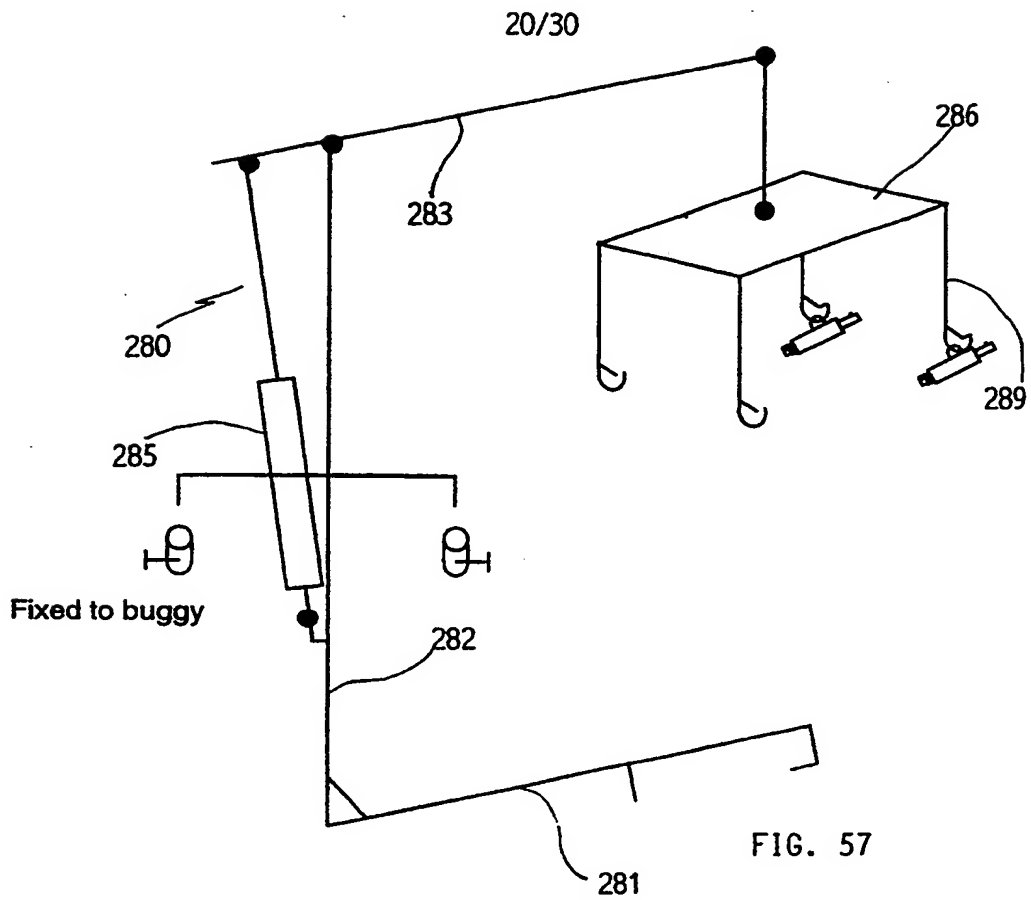


FIG. 56



21/30

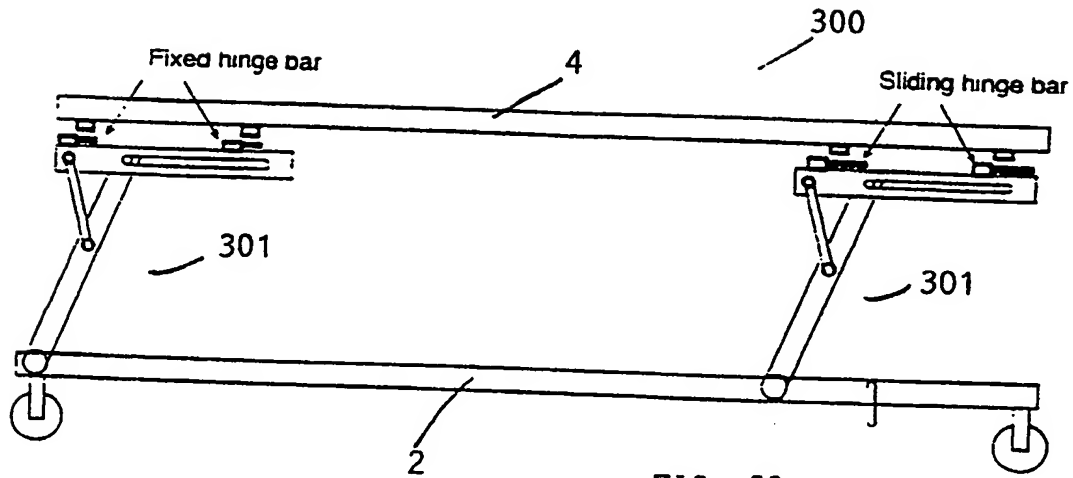


FIG. 59

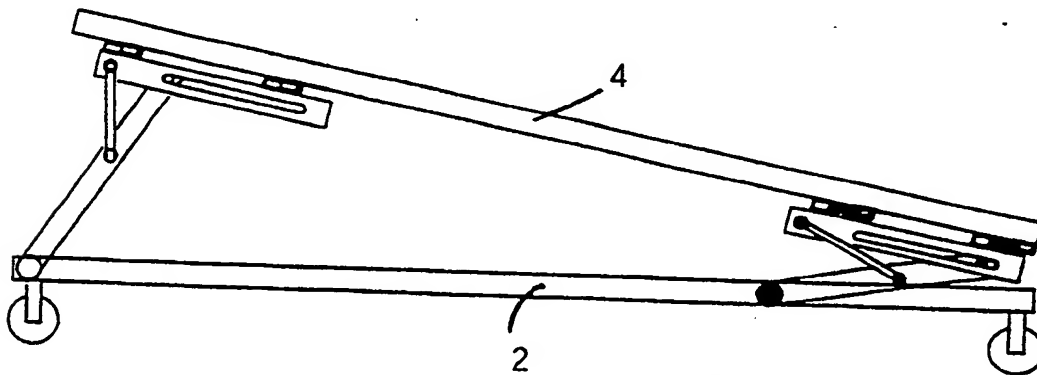


FIG. 60

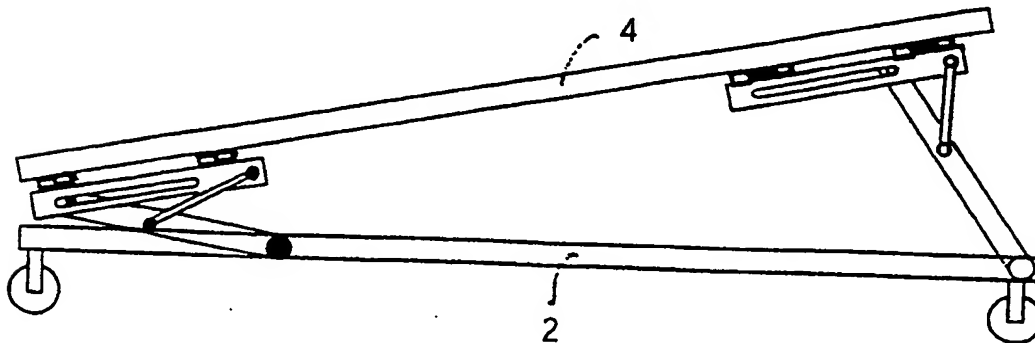
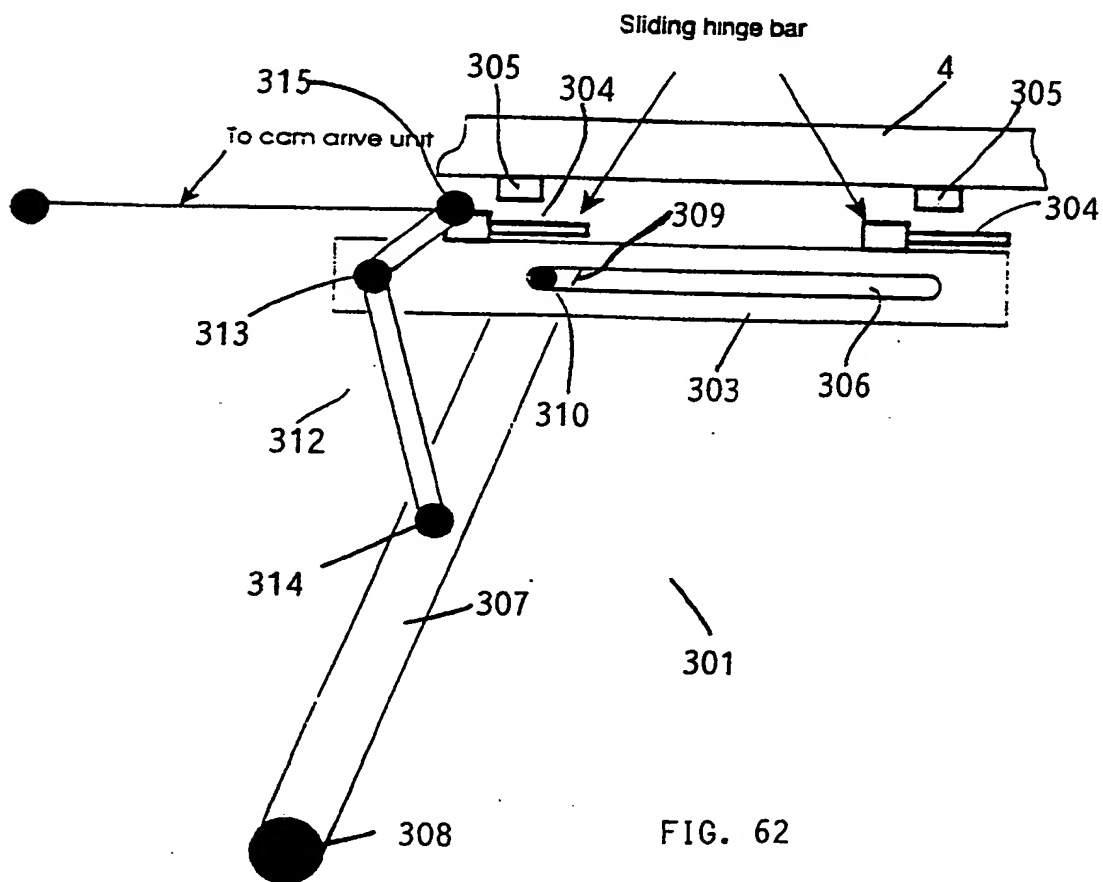
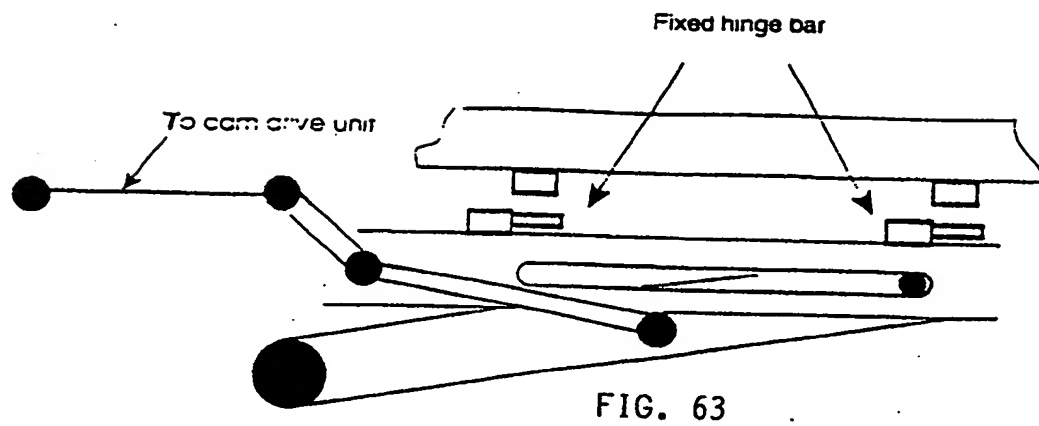


FIG. 61

22/30



23/30

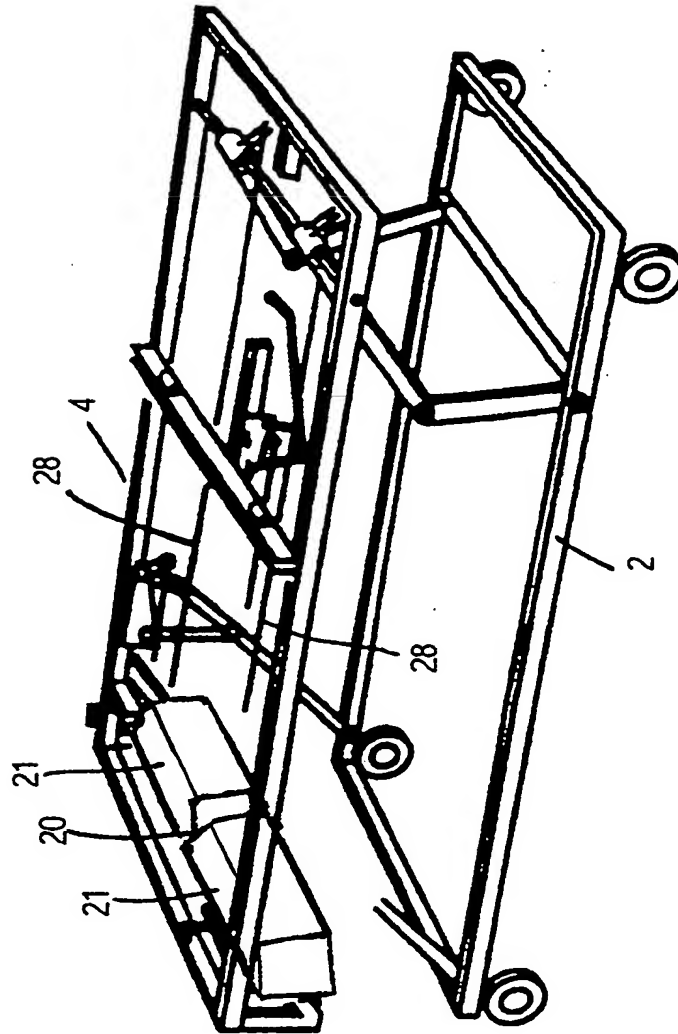


FIG. 64

24/30

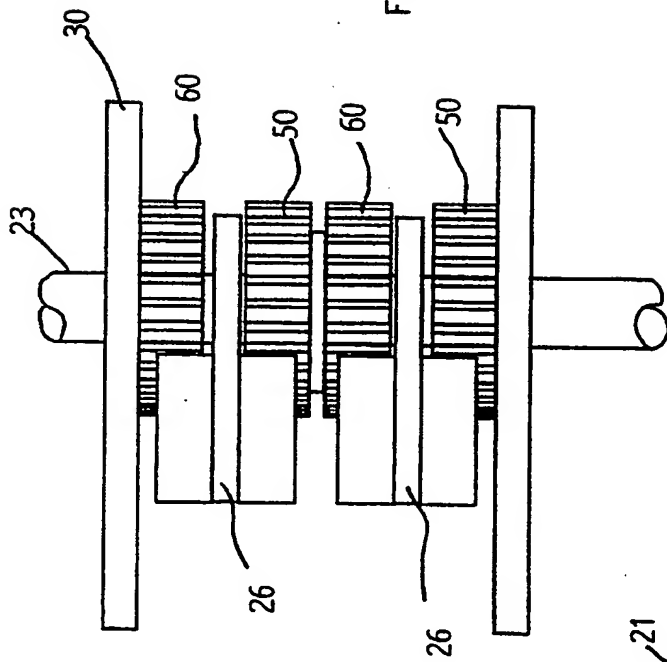


FIG. 66

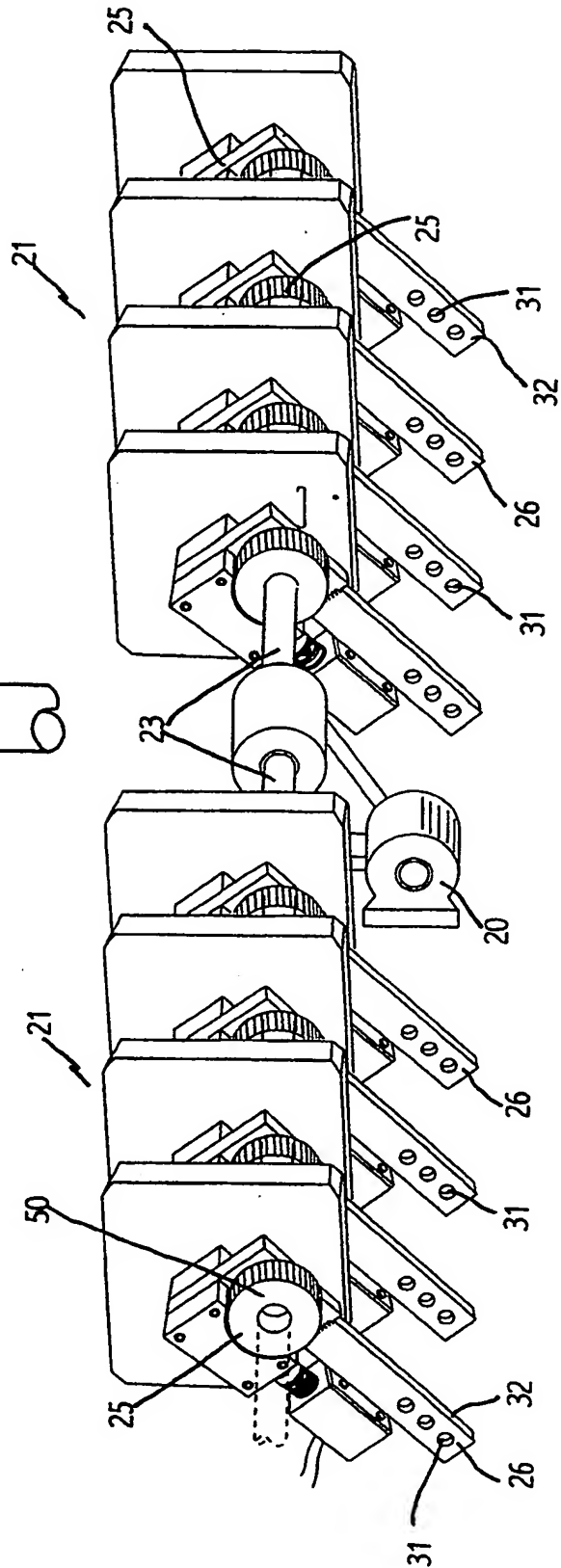
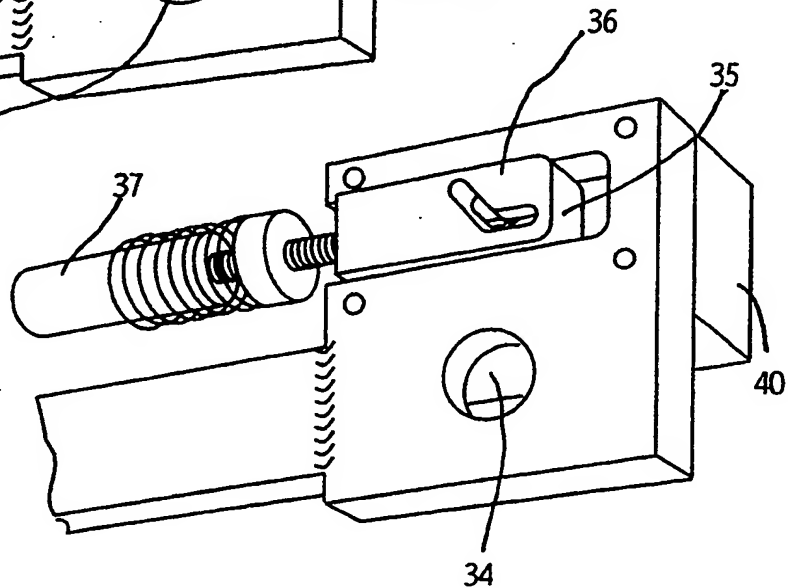
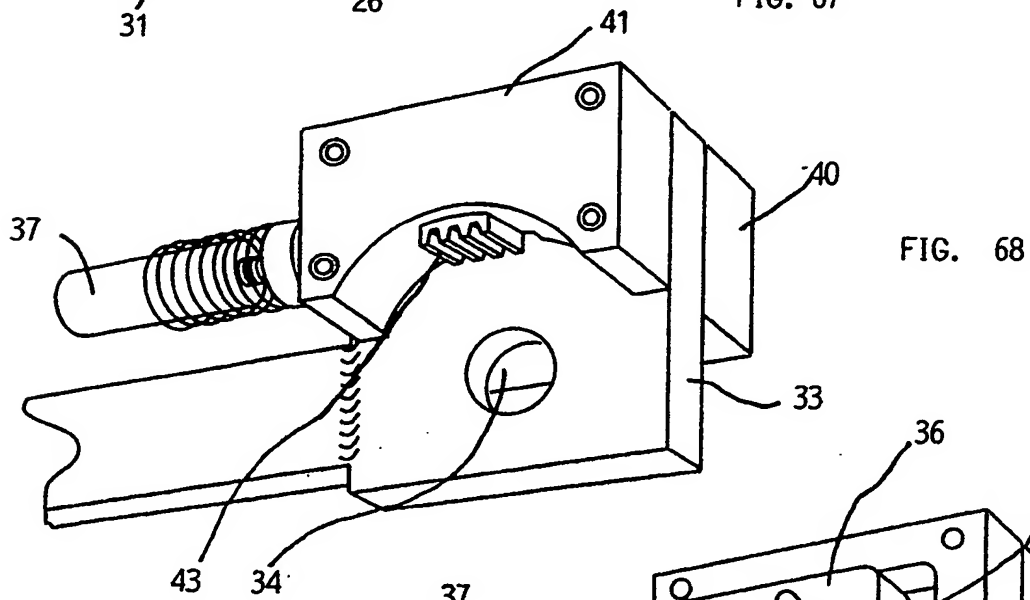
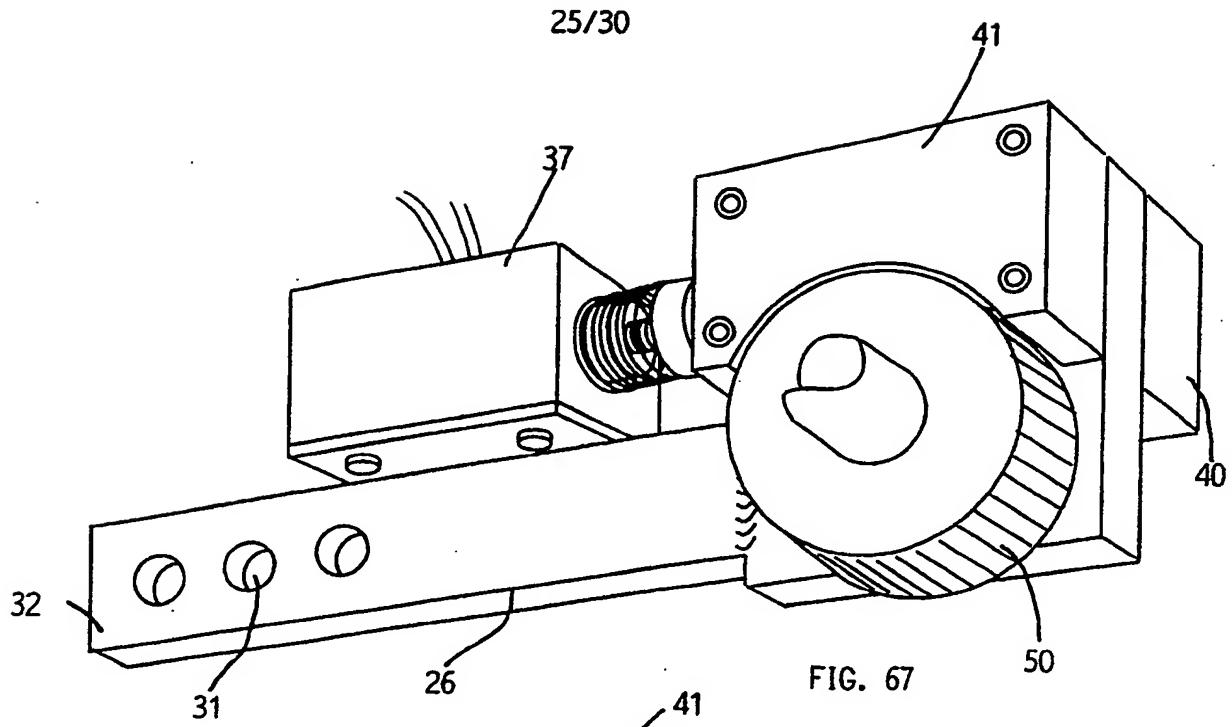


FIG. 65



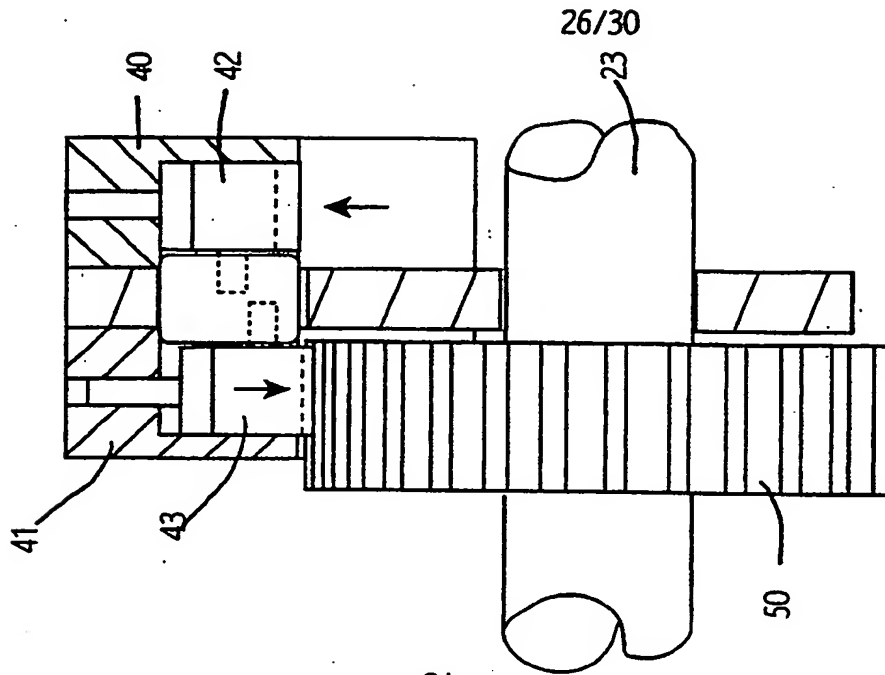


FIG. 70

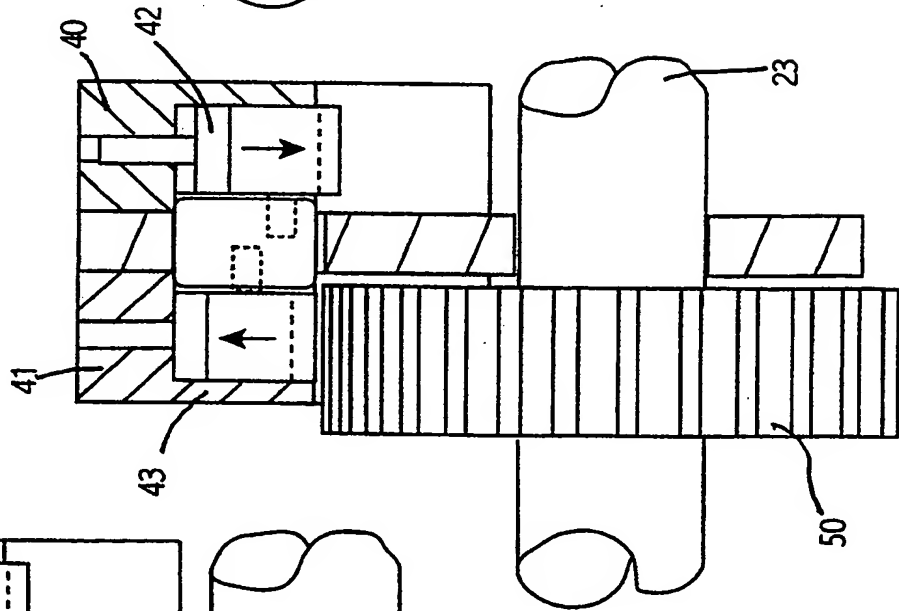


FIG. 71

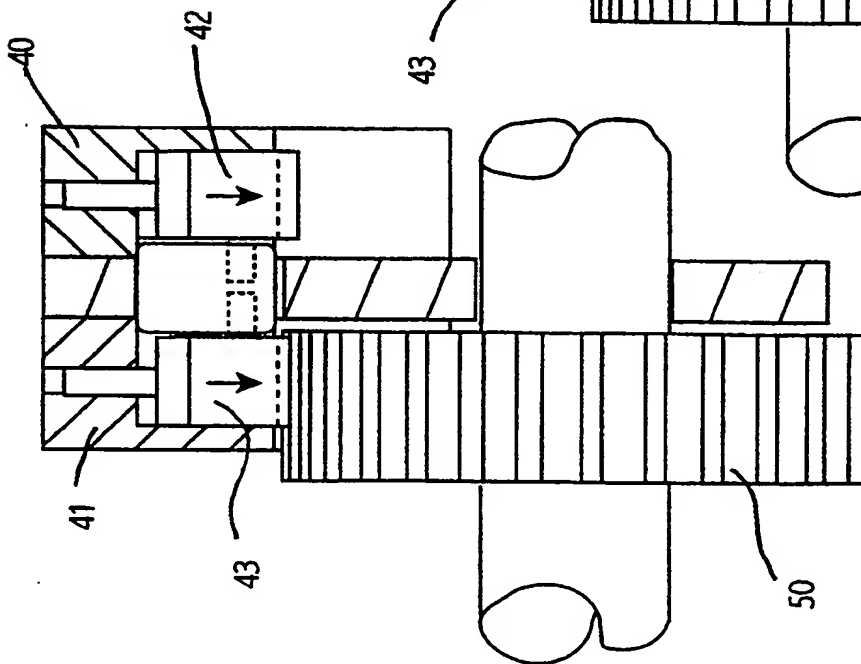


FIG. 72

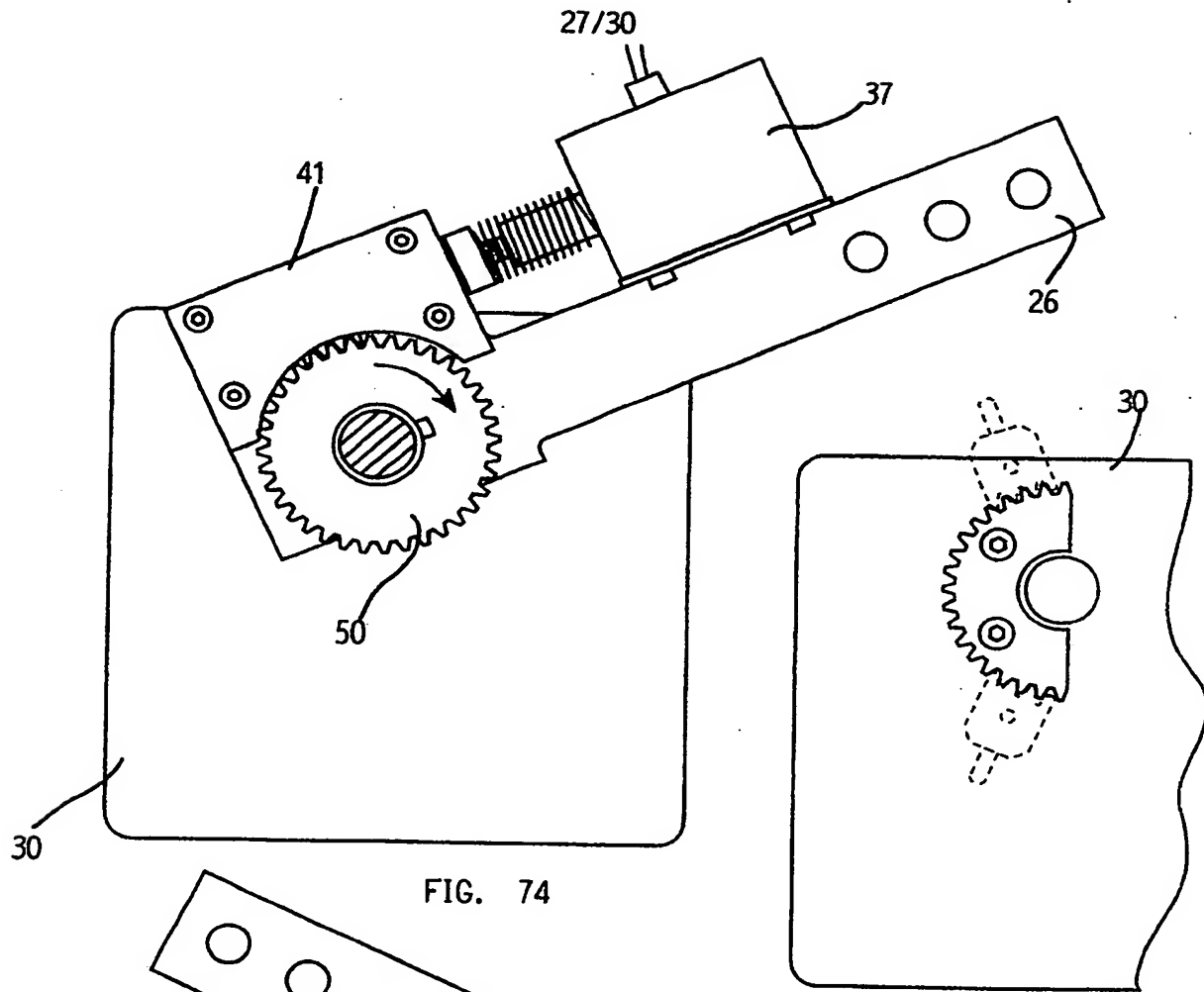


FIG. 74

FIG. 75

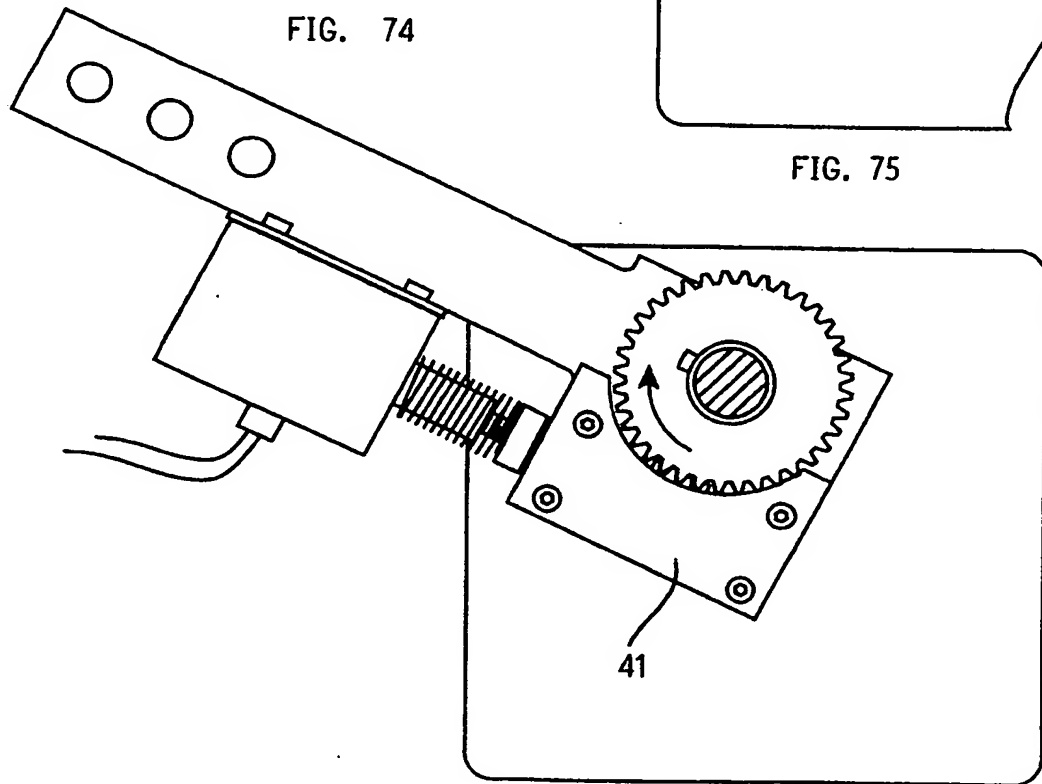
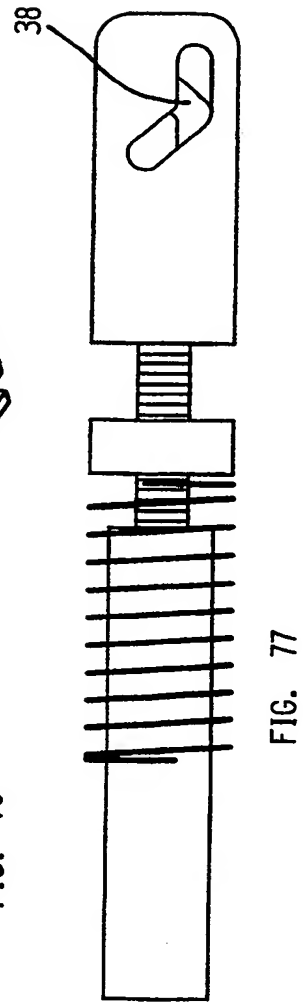
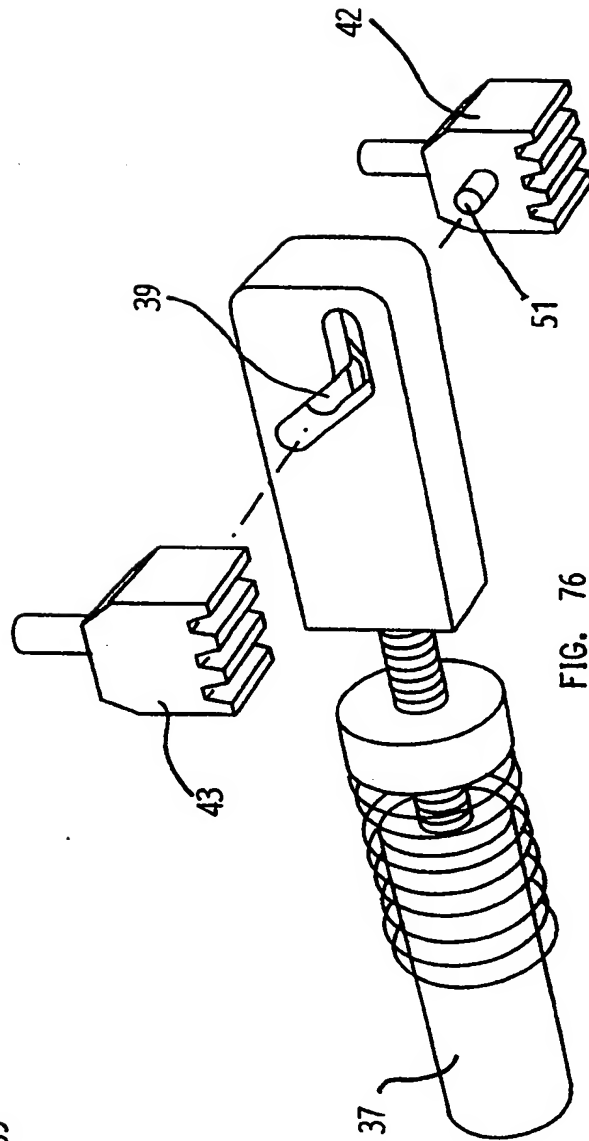
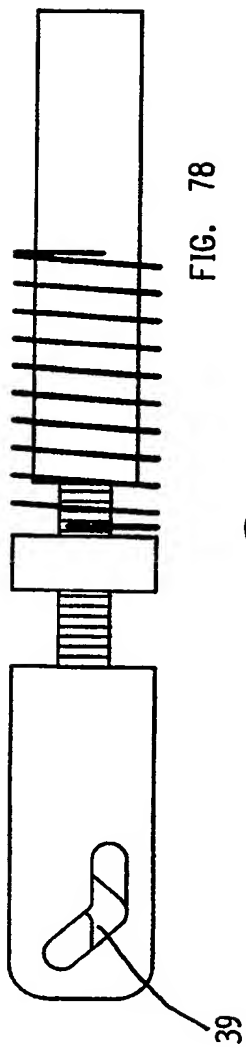


FIG. 73

28/30



29/30

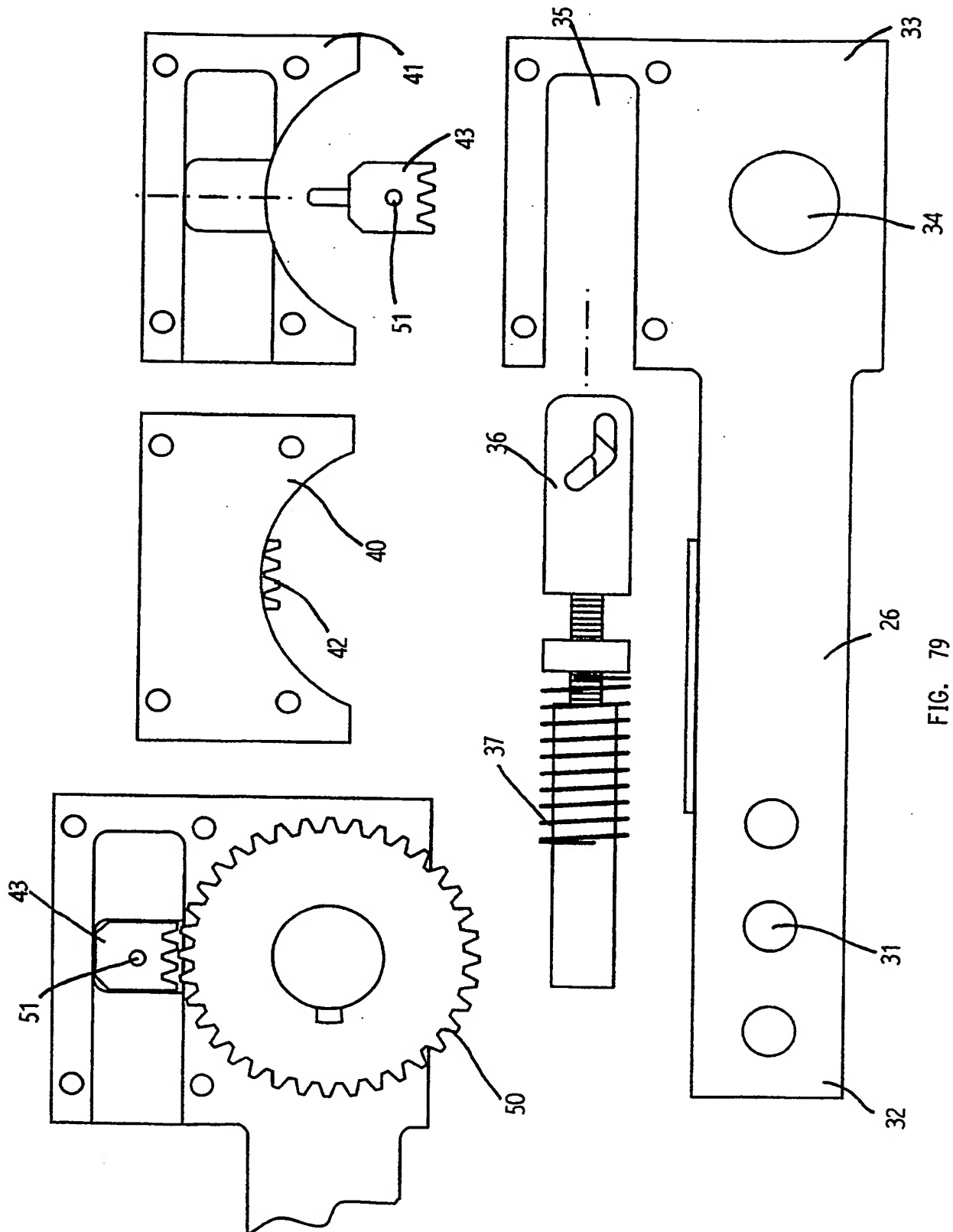


FIG. 79

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30/30

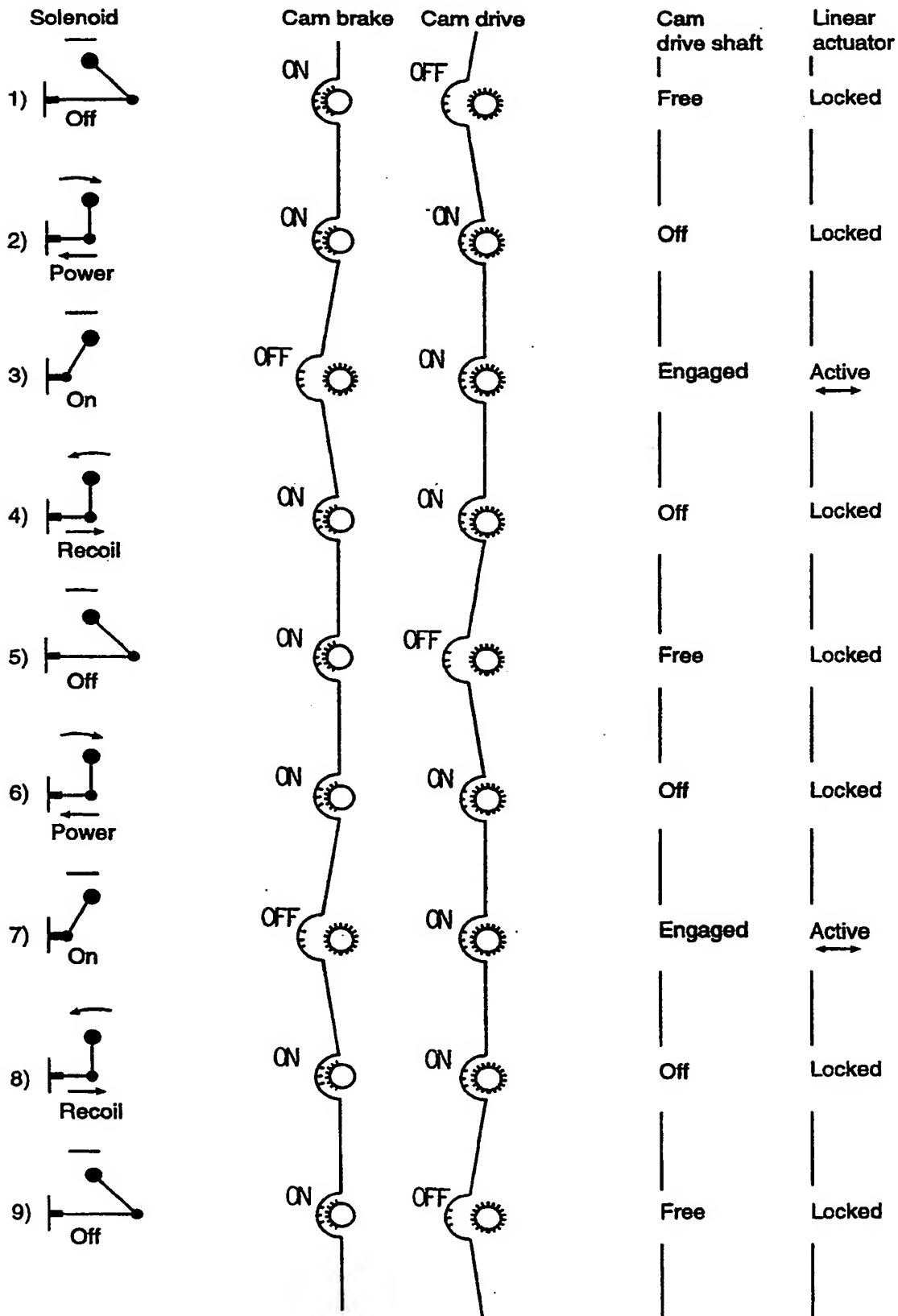


FIG. 80